CONNECTICUT RIVER FLOOD CONTROL PROJECT

EAST HARTFORD, CONN.

CONNECTICUT RIVER CONNECTICUT

SPECIFICATIONS

FOR

LOCAL PROTECTION WORKS

FISCAL YEAR 1939 SECTION, ITEM EH.2
CONTRACT - (R. R. SOUTH ALONG CONNECTICUT RIVER)

WAR DEPARTMENT CORPS OF ENGINEERS, U.S. ARMY

U.S. ENGINEER OFFICE, PROVIDENCE, R.I.

CONNECTICUT RIVER FLOOD CONTROL PROJECT

SPECIFICATIONS

FOR CONSTRUCTION OF

EARTH DIKE AND CONCRETE FLOOD WALL

FISCAL YEAR 1939 SECTION

EAST HARTFORD, CONNECTICUT.

JANUARY 14, 1939.

Issued April 28, 1939

CORPS OF ENGINEERS, U. S. ARMY

U. S. ENGINEER OFFICE PROVIDENCE, R. I.

No._____ Bidder_____ Invitation No. 699-39-291
(Do not write above this line)

STANDARD GOVERNMENT FORM OF INVITATION FOR BIDS
(Construction Contract)

War Department,
United States Engineer Office,
Providence, R. I.
April 28, 1939.

SEALED BIDS, in duplicate, subject to the conditions contained herein, will be received until 2 P.M., Daylight Saving Time, May 27, 1939, and then publicly opened, for furnishing all plant, labor and materials and performing all work for the construction of an earth dike and concrete flood wall, located on the Connecticut River at East Hartford, Connecticut.

I. THE WORK shall be in strict accordance with the specifications, bidding schedule and drawings, designated as follows:

Specifications for constructing Earth Dike and Concrete Flood Wall on the Connecticut River in East Hartford, Connecticut.

The drawings which will become a part of this contract are designated in Paragraph 1-04 of the specifications. Where copies of drawings are requested a deposit of $10.00 will be required to insure their return. This deposit should be in the form of a United States money order or a certified check, made payable to "The Disbursing Officer, U. S. Engineer Office, Providence, Rhode Island." The $10.00 deposit for each complete set of drawings will be refunded upon return of said drawings in good condition within 60 days after date of opening bids.

II. GUARANTEE will be required with each bid as follows: Bid bond, Standard Form No. 24, will be executed in a penal sum approximately equal to and not less than ten (10) per cent of the total amount of the bid. Individual sureties will justify in sums aggregating not less than double the penalty of the bid bond. (See Paragraphs 8 to 11, inclusive, of Instructions to Bidders.) Certified check may be furnished in lieu of bid bond.

III. PERFORMANCE AND PAYMENT BONDS will be required from the successful bidder as follows: a. A performance bond with good and sufficient surety or sureties, for the protection of the United States, Standard Form No. 25, will be executed in a penal sum approximately equal to and not less than fifty (50) per cent of the full amount of the consideration of the contract.

b. If the consideration of the contract will exceed $2,000.00 in amount, but shall not be more than one million dollars ($1,000,000.00), a payment bond with good and sufficient surety or sureties, for the protection of persons furnishing material and labor for the work, Standard Form No. 25-A, will be executed in a penal sum approximately equal to and not less than fifty (50) per cent of the full amount of the consideration of the contract; forty (40) per cent where the contract exceeds one million dollars ($1,000,000.00) but is not more than five million dollars ($5,000,000.00); and two million five hundred dollars ($2,500,000.00) for all contracts above five million dollars ($5,000,000.00).

IV. LIQUIDATED DAMAGES for delay will be prescribed. (See Paragraph 1-07 of the specifications).

V. TAX ADJUSTMENTS. - Provisions for tax adjustments will be made a part of the contract. (See Paragraph 1-12 of the specifications).

VI. PARTIAL PAYMENTS will be made. (See Article 16 of the contract and Paragraph 1-10 of the specifications).

VII. ARTICLES ON PATENTS will be made a part of the contract. (See Paragraph 1-16 of the specifications).

VIII. BID AND CONTRACT. - a. Bids must be submitted upon the Standard Government Form of Bid and the successful bidder will be required to execute the Standard Government Form of Contract for construction. The bid form has an entry for each item on which estimates will be given or payments made, and no other allowances of any kind will be made unless specifically provided for in the specifications or the contract. A bid for the entire work must have each blank filled.

b. Bidders shall submit alternate bid items for constructing a portion of the embankment (See Paragraphs 4-06 b and 6-06 a (3)). In computing the total amount of each proposal, the lowest alternate bid item will be used.

c. The quantities of each item of the bid, as finally ascertained at the close of the contract, in the units given and the unit prices of the several items stated by the bidder in the accepted bid, will determine the total payments to accrue under the contract. The unit price bid for each item must allow for all collateral or indirect cost connected with it.

d. The successful bidder will be required to return the contract duly executed and to furnish the performance and payment bonds hereinbefore described, within ten (10) days after the papers are presented to him.

IX. EXPERIENCE. - a. Each bidder shall state in his bid whether he is now or ever has been engaged on any contract or other work similar to that proposed, giving the year in which it was done and the manner of its execution, and shall submit such other information as will tend to show his ability to prosecute vigorously the work required by these specifications.

b. Each bidder will submit with his bid a list of the numbers of persons expected to be employed on the work in each class as contained in Paragraph 1-30 of the specifications, a nd the number of months they will be employed.

X. COMMENCEMENT AND COMPLETION. - Work shall be commenced within ten (10) calendar days after receipt of notice to proceed and shall be completed within 400 calendar days, in accordance with the provisions of Paragraph 1-07 of the specifications.

XI. MINIMUM WAGE RATES for the locality of the work have been determined by the U. S. Department of Labor, and proof of payment of such wages will be required. (See Articles 17 and 19 of the contract and Paragraph 1-35 of the specifications.)

XII. ARTICLES ON RELIEF LABOR will be made a part of the contract. (See Paragraph 1-30 of the specifications.)

XIII. EIGHT-HOUR LAW. - The requirements of the Eight-Hour Law, Article 11 of the contract, will be applicable to the work under the contract.

XIV. ARTICLES ON PREFERENCE for domestic materials will be made a part of the contract. (See Article 18 of the contract and Paragraph 1-31 of the specifications.)

XV. REPORTS TO THE DEPARTMENT OF LABOR. - In order to assist the Department of Labor in obtaining employment statistics, bidders, unless otherwise indicated in their bids, will be considered as having voluntarily consented, without cost to the Government, to the inclusion of Paragraph 1-36 of the specifications as a part of the contract.

XVI. INVESTIGATION OF CONDITIONS. - Samples of borings and from test pits taken at the site of the work can be seen at the U. S. Engineer Laboratory at Providence, Rhode Island, where they should be inspected by prospective bidders. Bidders are expected to visit the locality of the work and acquaint themselves with all available information concerning the nature of the materials to be excavated from the borrow or structure excavations, the nature of the materials to be transported and placed in the embankments and the local conditions bearing on transportation, handling and storage of materials. They are also expected to make their own estimates of the facilities needed, the difficulties attending the execution of the proposed contract including local conditions, availability of labor, uncertainties of weather, and

other contingencies. In no case will the Government assume any responsibility whatever for any interpretation, deduction, or conclusion drawn from the examination of the site. At bidder's request a representative of the Government will point out the site of the proposed operations. Failure to acquaint himself with all available information concerning these conditions will not relieve the successful bidder of assuming all responsibility for estimating the difficulties and costs of successfully performing the complete work.

XVII. FACILITIES AVAILABLE FOR CONSTRUCTION are described in Paragraph 1-06 of the specifications.

XVIII. DATA TO BE SUBMITTED WITH BIDS. - a. Each bidder shall submit with his bid drawings showing proposed plant layout and charts showing the rate of progress the bidder will maintain on the work, carefully prepared and presented in neat and legible form. These data are considered essential in assisting the contracting officer to determine whether or not the bidder is responsible, experienced in similar types of construction, and that his bid is based on a careful study of construction methods applicable to the work, and with a full realization of the various factors which may affect its progress.

b. The drawings indicating the plant layout shall clearly show the location and manner of employment of the various major items of plant, the method of excavation and disposal of materials, and the manner in which structural features will be erected.

c. The progress charts shall indicate the volume of work to be done and the rate of progress which the bidder agrees to maintain for each of the following major operations required in the performance of the work under these specifications: Excavations, Concreting, Earth Embankment, and Riprap. These charts may be in any convenient form in which the time element shall be plotted to represent definite intervals of time measured from date of notice to proceed with the work, and the volume of work shall be represented by a suitable scale of percentage of completion based on the estimated contract quantities. Careful consideration shall be given to the preparation of the charts as the contractor will be required to maintain the rate of progress indicated thereon.

XIX. PLANT. - Each bidder shall state in his bid the character and amount of plant that he proposes to employ on the work. After bids are opened any bidder may be required to show that he owns, controls or can procure the plant necessary for commencing, prosecuting, and completing the work as required by the specifications.

XX. AWARD OF CONTRACT. - a. Subject to the rights hereinafter reserved, the work will be awarded as a whole to the lowest bidder whose proposal fully conforms with the requirements of the specifications and as may be deemed most advantageous to the Government. The right is reserved as the interest of the Government may require, to reject any

and all bids, and to waive any informality in bids received.

b. A bid may be rejected if the bidder cannot show that he has the necessary capital and experience, and owns, controls or can procure the necessary plant to commence the work at the time prescribed in the specifications and thereafter to prosecute and complete the work at the rate or time specified; and that he is not already obligated for the performance of other work which would delay the commencement, prosecution or completion of the work contemplated in this advertisement.

c. Any unbalanced bid which, in the opinion of the contracting officer, jeopardizes the interest of the United States will be subject to rejection for that reason.

XXI. ADDRESS FOR BIDS. - Bids submitted must be in envelopes with sufficient postage, sealed, marked and addressed as follows:

(Marked in upper left-hand corner)

Bid for construction of earth dike and concrete flood wall on the Connecticut River at East Hartford, Conn.

To be Opened May 27, 1939.

(Addressed to)

District Engineer,
United States Engineer Office,
819 Industrial Trust Bldg.,
Providence, Rhode Island.

Note:-- See Standard Government Instructions to bidders and copy of the Standard Government Forms of contract, bid bond, payment bond, and performance bond, which may be obtained upon application.

TABLE OF CONTENTS

SPECIFICATIONS

SECTION I. GENERAL PROVISIONS

DETAILED SPECIFICATIONS

WAR DEPARTMENT
UNITED STATES ENGINEER OFFICE
PROVIDENCE, RHODE ISLAND

APPROPRIATIONS: 713022-658/9999-Emergency Relief, War, Corps of Engineers, Public Buildings, Parks, Utilities, Flood Control, etc. (Transfer from WPA), 1938-1939.
21-408/00583 Public Works Administration Act of 1938 (Allotment to War, Flood Control), 1938-1940.

DIKE AND WALL AT EAST HARTFORD ALONG THE CONNECTICUT RIVER (FISCAL YEAR 1939 SECTION)

EAST HARTFORD, CONNECTICUT

S P E C I F I C A T I O N S

SECTION I. GENERAL PROVISIONS

1-01. Location. - The site of the work covered by these specifications is located on the east bank of the Connecticut River, in the westerly portion of the Town of East Hartford, Connecticut, known as "The Meadows."

1-02. Work to be done. - a. The work provided for herein is authorized by the Flood Control Act of June 28, 1938.

b. The work to be done under the contract consists of furnishing all plant, labor and materials and performing all work required for constructing an earth dike and concrete flood wall approximately 6,700 feet in total length, complete in accordance with these specifications and the drawings forming a part hereof, together with such incidental work as needed or ordered in writing by the contracting officer. It will consist of the following principal items of construction:

(1) Construction of an earth dike between Stations 98+00 and 125+50, 130+70 and 144+50, 150+20 and 170+00.

(2) Construction of a concrete flood wall between Stations 144+50 and 150+20, at the bulk oil terminal.

(3) Steel sheet piling cut-off between Stations 110+50 and 116+50, also between Stations 142+50 and 170+00.

(4) Construction of drainage system and outfalls as indicated on the drawings.

c. As indicated on the drawings, the limit of the contract work downstream will be Station 170+00. In the event that bid prices and funds available will not permit work to be carried out to Station 170+00, the work will be curtailed from Station 170+00 upstream as directed by the contracting officer. In any event, the concrete wall at the bulk oil terminal will be constructed in preference to certain items of the embankment.

d. The quantities indicated in Paragraph 1-05 are based on all work items upstream from Station 170+00.

1-03. Description of the work. - a. The dike will be of the rolled-fill type, about 6,100 feet long, with a maximum height of about 30 feet. It will be of pervious material with a cut-off and blanket on the riverside of selected impervious material. The slopes of the dike will be sodded and seeded as indicated on the drawings. The crest of the dike will be covered with a layer of compacted gravel. Crushed stone and tile drains will be installed to provide proper drainage for the landside toe of the dike. These drains lead to outfalls as indicated on the drawings. Sheet piling shall be placed as indicated on the drawings.

b. The flood wall will be constructed of reinforced concrete with a sheet pile cut-off and will be approximately 570 feet in length, with a top elevation averaging 37.4 feet m.s.l.

1-04. Drawings. - a. The work shall conform to drawings marked "East Hartford Dike, Fiscal Year 1939 Section, Connecticut River, Conn.," as listed below, which drawings form a part of these specifications and are filed in the United States Engineer Office, Providence, Rhode Island.

LIST OF DRAWINGS

Sheet No.	Title	File No.
1	Project Location and Index	CT-4-1312
2	Hydrographs No. 1	CT-3-1091
3	Hydrographs No. 2	CT-3-1092
4	Subsurface Explorations	CT-2-1137
5	Record of Subsurface Explorations No. 1	CT-2-1138
6	Record of Subsurface Explorations No. 2	CT-2-1139
7	Record of Subsurface Explorations No. 3	CT-2-1131
8	River Cross Sections	CT-2-1117
9	Borrow Areas	CT-2-1136
10	General Plan	CT-4-1245
11	Plan and Profile No. 1	CT-4-1313
12	Plan and Profile No. 2	CT-4-1314
13	Plan and Profile No. 3	CT-4-1315
14	Plan and Profile No. 4 (not in contract)	CT-4-1316
15	Embankment Details No. 1	CT-4-1317
16	Embankment Details No. 2	CT-4-1318
17	Embankment Details No. 3	CT-4-1319
18	Embankment Details No. 4	CT-4-1320

Sheet No.	Title	File No.
19	Embankment Details No. 5	CT-4-1321
20	Ramp No. 1	CT-4-1322
21	Ramp No. 2	CT-4-1323
22	Ramp No. 3	CT-4-1324
23	Ramp No. 4 (not in contract)	CT-4-1325
24	Crib Wall Details	CT-4-1326
25	Steel Sheet Piling	CT-4-1327
26	Drainage System No. 1	CT-4-1328
27	Drainage System No. 2	CT-4-1329
28	Drainage System No. 3	CT-4-1330
29	Drainage Structures No. 1	CT-4-1331
30	Drainage Structures No. 2 (not in contract)	CT-4-1332
31	Drainage Structures No. 3	CT-4-1333
32	Drainage Structures Steel Reinforcement No. 1	CT-4-1334
33	Drainage Structures Steel Reinforcement No. 2)not in	CT-4-1335
34	Drainage Structures Steel Reinforcement No. 3)contract	CT-4-1336
35	Drainage Structures Steel Reinforcement No. 4	CT-4-1337
36	Drainage Structures Steel Reinforcement No. 5	CT-4-1338
37	Drainage Structures Steel Reinforcement No. 6	CT-4-1339
38	Cherry Street Outfall - Plan and Profile	CT-4-1340
39	Cherry Street Outfall - Valve Chamber No. 1	CT-4-1341
40	Cherry Street Outfall - Valve Chamber No. 2	CT-4-1342
41	Cherry Street Outfall - Misc. Details	CT-4-1343
42	Cherry Street Outfall Steel Reinforcement No. 1	CT-4-1344
43	Cherry Street Outfall Steel Reinforcement No. 2	CT-4-1345
44	Cherry Street Outfall Steel Reinforcement No. 3	CT-4-1346
45	Cherry Street Outfall Steel Reinforcement No. 4	CT-4-1347
46	Pitkin Street Outfall - Plan and Profile	CT-4-1348
47	Pitkin Street Outfall - Valve Chamber No. 3	CT-4-1349
48	Pitkin Street Outfall - Valve Chamber No. 4	CT-4-1350
49	Pitkin Street Outfall Steel Reinforcement No. 1	CT-4-1351
50	Pitkin Street Outfall Steel Reinforcement No. 2	CT-4-1352
51	Pitkin Street Outfall Steel Reinforcement No. 3	CT-4-1353
52	Concrete Flood Wall - Existing Topography	CT-4-1354
53	Concrete Flood Wall - Plan and Profile	CT-4-1355
54	Concrete Flood Wall - Details No. 1	CT-4-1356
55	Concrete Flood Wall - Details No. 2	CT-4-1357
56	Concrete Flood Wall - Details No. 3	CT-4-1358
57	Concrete Flood Wall - Details No. 4	CT-4-1359
58	Concrete Flood Wall - Details No. 5	CT-4-1360
59	Concrete Flood Wall - Details No. 6	CT-4-1361
60	Concrete Flood Wall - Bulkhead Door	CT-4-1362
61	Concrete Flood Wall Steel Reinforcement No. 1	CT-4-1363
62	Concrete Flood Wall Steel Reinforcement No. 2	CT-4-1364
63	Concrete Flood Wall Steel Reinforcement No. 3	CT-4-1365
64	Concrete Flood Wall Steel Reinforcement No. 4	CT-4-1366
65	Concrete Flood Wall Steel Reinforcement No. 5	CT-4-1367
66	Concrete Flood Wall Steel Reinforcement No. 6	CT-4-1368
67	Concrete Flood Wall Steel Reinforcement No. 7	CT-4-1369

Sheet No.	Title	File No.
68	Concrete Flood Wall Steel Reinforcement No. 8	CT-4-1370
69	Reinforcement Schedule No. 1	CT-4-1371
70	Reinforcement Schedule No. 2	CT-4-1372
71	Reinforcement Schedule No. 3	CT-4-1373
72	Reinforcement Schedule No. 4	CT-4-1374

b. The work shall also conform to such other drawings relating thereto as may be exhibited in the office of the contracting officer prior to the opening of proposals and to such drawings used in explanation of details as may be required from time to time during construction, including such minor modifications as the contracting officer may consider necessary on account of conditions discovered during the prosecution of the work.

c. Prior to performing the work, the contractor shall check all drawings and shall immediately report to the contracting officer any errors or omissions discovered therein. Quantities stated in bills of material on contract drawings are approximate only. The contractor shall be responsible for furnishing the required quantity without change in unit price. All items to be furnished at lump sum prices shall be provided by the contractor, complete and in good working order, regardless of whether or not they are fully shown or listed on the contract drawings. Parts and details not fully indicated on the drawings shall be detailed by the contractor in accordance with the best engineering practice, and 4 copies of each drawing shall be submitted to the contracting officer for approval. Each sheet of drawings submitted for approval shall be provided with a blank white space approximately 5 inches by 4 inches near the lower right-hand corner, just above the title, in which the contracting officer may indicate the action taken. After approval by the contracting officer, but before the work indicated on the contractor's drawings is commenced, one copy of each approved drawing will be furnished the contractor. These approved drawings shall form a part of the contract. The Government will not be responsible for minor errors or minor discrepancies of the contract drawings. Drawings furnished by the contractor for approval by the contracting officer shall be made with ink on tracing cloth. Upon completion of the project, the contracting officer shall be furnished with "Van Dyke" negatives of the contractor's drawings, corrected to show all revisions made during construction.

d. Ten sets of prints of all necessary drawings will be furnished the contractor without charge. Additional prints will be furnished upon request at the cost of printing.

1-05. Quantities. - The following estimate of quantities is given only to serve as a basis for the comparison of bids and for determining the approximate amount of the consideration of the contract. Within the limits of available funds, the contractor will be required to complete the work specified in Paragraph 1-02, whether it be more or less than that estimated, and final payment will not be made until the work is so completed.

Item No.	Designation	Unit	Quantity
1	Preparation of Site	acre	8.0
2	Care and Diversion of Water and Sewage	job	---
3	Stripping	cu.yd.	12,300
4	Common Excavation, General	" "	13,100
5	Impervious Borrow Excavation, Borrow Area "E"	" "	43,000
6	Impervious Borrow Excavation, Borrow Area "C"	" "	88,000
7	Pervious and Random Borrow Excavation (Dredging from River to Stockpile and Rehandling to Embankment	" "	267,000
*7A	Pervious and Random Borrow Excavation (Dredging from River Direct to Embankment)	" "	170,000
8	Common Excavation, Cut-off Trench	" "	14,000
9	Common Excavation, Sewer Trench	" "	4,900
10	Removal of Masonry Structures and Foundations	job	---
11	Steel Sheet Piling	sq.ft.	125,000
12	Impervious Fill, Placing and Rolling	cu.yd.	116,000
13	Pervious and Random Fill, Placing and Rolling	" "	303,000
14	Gravel Bedding	" "	7,900
15	Compacted Backfill	" "	3,200
16	Semi-Compacted Backfill	" "	10,500
17	Miscellaneous Fill	" "	4,000
18	Dumped Rock Fill	" "	200
19	Riprap, Hand Placed	" "	11,200
20	Grouted Stone Gutters		
	a. 8" thick	sq.yd.	370
	b. 12" thick	" "	650
21	10" Corrugated Pipe	lin.ft.	24
22	Tile Pipe, 4" V.C.	" "	20
23	Tile Pipe, 8" V.C.	" "	95
24	Tile Pipe, 10" V.C.	" "	30
25	Tile Pipe, 15" V.C.	" "	905
26	Tile Pipe, 18" V.C.	" "	984
27	Tile Pipe, 20" V.C.	" "	412
28	Tile Pipe, 24" V.C.	" "	412
29	(Deleted)		
30	Cast Iron Pipe		
	a. 30"	" "	186
	b. 36"	" "	236
31	Reinforced Concrete Pipe		
	a. 30"	" "	612
	b. 36"	" "	44
32	Gate Valves		
	a. 30"	each	2
	b. 36"	"	2
33	Flap Valves		
	a. 30"	"	1
	b. 36"	"	1

Item No.	Designation	Unit	Quantity
34	Sluice Gates, 36"	each	2
35	Removing Old Sewer Pipe	job	---
36	Manholes, Complete	each	10
37	Portland Cement	bbl.	6,800
38	Concrete in Flood Wall	cu.yd.	4,700
39	Concrete in Miscellaneous Structures	" "	280
40	Steel Reinforcement	lb.	436,000
41	Miscellaneous Structural Steel	lb.	1,000
42	Miscellaneous Iron and Steel	lb.	5,100
43	Copper Water Stops	lb.	700
44	Topsoil on Embankment	cu.yd.	11,500
45	Sodding and Seeding	acre	12
46	Surfacing for Top of Dike	cu.yd.	900
47	Gravel for Roads	" "	450
48	Bituminous Macadam Road Surface	sq.yd.	1,170
49	Concrete Cribbing	cu.ft.	1,850
50	Alterations to Existing Bulkhead Anchors	job	---
51	8" Porous Concrete Pipe	lin.ft.	3,850
52	10" Porous Concrete Pipe	" "	1,380
53	12" Porous Concrete Pipe	" "	870
**51A	8" Corrugated Pipe, Perforated	" "	3,850
**52A	10" Corrugated Pipe, Perforated	" "	1,380
**53A	12" Corrugated Pipe, Perforated	" "	870

*Item 7A is an alternate to Item 7 for the quantity stated if the contract is written to include Item 7A. The same decrease in quantity will also apply to Item 13.

**Alternate to Items 51, 52, and 53 respectively. Not to be included in totals.

1-06. Physical data. - a. General. - Materials for constructing the earth dike are available in the vicinity of the work, except for one borrow area about 4 miles distant (see Paragraph 4-06). Locations of borrow areas are shown on the drawings. Borings and test pits have been made in the vicinity of the proposed work with reasonable care and substantially at the places indicated on the drawings. Laboratory analyses have been made of the samples from many bore holes and test pits. Samples of materials taken from them, and records of laboratory analyses and other studies may be seen at the U. S. Engineer Office, Providence, Rhode Island. It is expressly understood that the Government will not be responsible for any deduction, interpretation, or conclusions made by the contractor from his inspection of the available samples and records. These samples of materials and contract drawings represent all the pertinent information on subsurface exploration which the Government has made at the site. Concrete aggregates shall be obtained from approved commercial sources.

b. Transportation facilities. - (1) Railroads. - The New York, New Haven and Hartford Railroad serves the Town of East Hartford

with main line traffic. The contractor shall investigate the availability of the sidings from the railroad company and make all arrangements with the latter for the use of any sidings for the delivery of any materials and equipment to be used on the work.

(2) Waterways. - A 15-foot channel with 94-foot minimum overhead clearance is maintained in the Connecticut River up to the highway bridge at East Hartford. Above the bridge there is limited draft and overhead clearance. For navigation data see U. S. Coast and Geodetic Survey Charts Nos. 215, 254, 255 and 256. The normal river stage is 3.5 feet m.s.l. at the East Hartford bridge, and usually varies from a low stage of 1.5 feet m.s.l. in August to a high stage of 20+ feet m.s.l. in April. Freshets producing higher stages may occur at any month of the year as a result of heavy rainfall.

(3) Highways. - First-class highways also serve the town. The contractor shall provide for his own construction or access roads and their maintenance. He shall make his own investigation of available roads for transportation, of load limits for bridges and roads, and other road conditions affecting the transportation of materials and equipment to the site of the work.

c. Weather conditions. - The locality is subject to atmospheric temperatures ranging from minus 18 degrees to plus 101 degrees Fahrenheit. The mean annual precipitation at East Hartford is 42.50 inches. The mean monthly precipitation varies from a low of 3.22 inches in June to a high of 4.20 inches in August.

1-07. Commencement, prosecution, and completion. - a. The contractor will be required to commence the work under the contract within ten (10) calendar days after date of receipt by him of notice to proceed, to prosecute the said work with faithfulness and energy, and to complete the entire work within 400 calendar days after said date of receipt of notice to proceed.

b. Liquidated damages. - In case of failure on the part of the contractor to complete the work within the time determined and agreed upon for its completion plus any extensions duly granted under the terms of the contract, the contractor shall pay the Government as liquidated damages for delay in completing the entire work under the contract, the sum of fifty dollars ($50.00) for each calendar day of delay until all work is completed or accepted.

1-08. Sundays, holidays, and nights. - No work shall be done on Sundays or on days declared by Congress as holidays for per diem employees of the United States except in cases of emergency, and then only with the written consent of the contracting officer. Work may be done at night when authorized in writing by the contracting officer.

1-09. Progress, organization, and plant. - a. The contractor shall employ at all times, an ample force of men with proper experience in their

respective assignments, and provide equipment and a construction plant properly adapted to the work, and of sufficient capacity and efficiency to accomplish the work in a safe and workmanlike manner at the rate of progress specified in his bid. All plant and equipment shall be maintained in good working order, and provision shall be made for immediate emergency repairs. The contracting officer may order the removal and require replacement of any unsatisfactory plant or equipment. No reduction in the capacity of the plant employed on the work shall be made, except under written permission of the contracting officer. The measure of "Capacity of the Plant" shall be its actual performance on the work to which these specifications apply. It is understood that award of this contract shall not be construed as a guarantee by the Government that the plant and equipment listed by the contractor in the bid form is adequate for the performance of the work.

b. Should the contractor fail to maintain the rate of progress proposed in his bid, the contracting officer may required that additional men, equipment or plant be placed on the work, or a reorganization of plant layout be effected in order that the work be brought up to schedule and maintained there. Should the contractor refuse or neglect to comply with these requirements to the satisfaction of the contracting officer, the contracting officer will proceed under the provisions of Article 9 of the contract.

1-10. Payments. - a. Payments will be made monthly in accordance with Article 16 of the contract for work executed and completed as specified or otherwise required, and not included in any prior estimate, subject to the conditions stipulated in these specifications for estimating for partial payments, except that 10 per cent of the amount of each estimate will be retained until the contract work is 50 per cent completed, and thereafter with each monthly payment there will be paid such portion of the amount so retained as is in excess of 10 per cent of the estimated cost of completing the work remaining to be done, until the amount retained is reduced to $20,000, after which the amount to be retained will remain unchanged until the completion of the contract.

b. From funds heretofore appropriated by the Public Works Administration Act of June 21, 1938, appropriation symbol 21-408/00583, and the Emergency Relief Appropriation Act of June 21, 1938, appropriation symbol 713022-658/9999, the sums of $365,000 and $275,000 respectively, have been initially allotted and will be reserved for payments in connection with this contract, including all costs of superintendence and inspection and all collateral and incidental expenses in connection therewith. Of these sums, the amount of about $500,000 is available for payment of the contractor's estimates.

1-11. Work covered by contract price. - The contractor shall, under his contract prices, furnish and pay for all material and labor, and all permanent, temporary, and incidental work, furnish all accessories, and do everything that may be necessary to carry out the work specified in good faith, which contemplates everything specified completed, of good

materials with accurate workmanship, skillfully fitted and properly connected and put together.

1-12. Tax adjustments. - The contract price will be considered to include all Federal, State and local taxes imposed prior to the date of opening bids and applicable to the undertaking. If any privilege, sales, gross receipt or other tax (exclusive of taxes on net income or undistributed profits) applicable to the undertaking and payable directly by the contractor, is imposed or changed after the date of opening bids by Federal or State enactment, then the contract price will be increased or decreased accordingly and any amount due or chargeable against the contractor as a result thereof will be adjusted on payment vouchers as separate items.

1-13. Material to be furnished by the contractor. - The contractor shall furnish all materials and equipment necessary to complete the work to be done under these specifications. The cost of unloading and loading, handling, hauling, storing and caring for materials furnished by the contractor shall be included in the contract prices for the work to which the materials pertain. All materials, supplies and articles delivered at the site shall be adequately housed or otherwise protected against deterioration and damage. When material stored at the site and partly paid for is not adequately protected by the contractor, such material will be kept protected by the contracting officer, at the expense of the contractor, and no further partial payments will be made thereon.

1-14. Order of work. - The work shall be carried on at such places and also in such order of precedence as may be found necessary by the contracting officer. The contractor shall submit, for approval of the contracting officer, his proposed program in writing giving the sequence of construction operations contemplated. The location and limits of the work to be done will be plainly indicated by stakes, lines, marks or otherwise as established by the contracting officer or his agents.

1-15. Damage. - Damage to Government property due to the failure of the contractor to take reasonable precaution, and all loss or deterioration of, or damage to any of the work by flood, accident or exposure prior to final acceptance of the work, shall be made good by the contractor without expense to the Government; except that the Government will compensate the contractor for repairs to the permanent work, if damaged by flooding or scouring. (See Paragraph 6-14 c.)

1-16. Patents. - The contractor shall hold and save the Government, its officers, agents, and employees harmless from liability of any nature or kind, including costs and expenses, for or on account of any patented or unpatented process, or invention, article, or appliance manufactured or used in the performance of this contract, including its use by the Government.

1-17. Grounds and right of way. - a. Grounds and right of way needed for the work to be done under these specifications will be furnished by the

Government. The Government will not be held liable for any delay in furnishing the grounds or right of way, but in case such delay retards the operations of the contract, the contracting officer will grant an extension of time for the completion of the work equal to the length of the delay (see Paragraph 1-07). The contractor shall have the privilege of using the Government controlled land at the site, not otherwise reserved by the contracting officer; provided, that plans for all construction, storage, or other operations proposed thereon by the contractor are submitted for approval of the contracting officer, prior to the occupation of such areas.

b. The contractor, without expense to the Government, at any time during the progress of the work and when space is needed for other purposes, shall vacate promptly and clean up any part of the grounds allotted to or in use by him, when directed to do so by the contracting officer.

1-18. Removal of rubbish. - The contractor shall keep the site free from rubbish. Suitable spoil areas for receiving refuse from the grounds shall be provided, and the rubbish shall be removed and disposed of as directed by the contracting officer. At the conclusion of the work, the site shall be cleaned up and all rubbish and unused materials shall be disposed of in accordance with Paragraph 13-09.

1-19. Obstruction and danger lights. - In the contractor's use of streets and highways, for the work to be done under these specifications, he shall conduct his operations so as to cause no greater obstruction to the traveling public than is considered necessary by the contracting officer. The contractor shall provide, erect and maintain effective barricades, danger signals, and signs on all intercepted roads or highways, and on the site where directed by the contracting officer for the protection of the work and the safety of the public. All barricades and obstructions which encroach on or are adjacent to public rights of way and all plant connected with the work when directed by the contracting officer shall be provided with lights at night and all such lights shall be kept burning between sunset and sunrise. Such barricades and lights shall conform to the local and State laws. The contractor shall be responsible for all damages resulting from any neglect or failure of these requirements. The expense of these and other safety precautions shall be borne by the contractor. If work at night is permitted by the contracting officer (see Paragraph 1-08), the contractor shall maintain from sunset to sunrise such lights on or about his plant as the contracting officer may deem necessary for the proper observation and execution of the work.

1-20. Inspection and supervision. - a. General. - The work will be conducted under the general direction of the contracting officer, and will be inspected in accordance with Article 6 of the contract, by inspectors appointed by him. The inspectors so appointed will be authorized to reject material or work which in their opinion does not conform to the requirements of the specifications. Any rejected material shall be removed from the site without delay, and any defective work shall be replaced. The contracting officer will furnish on request of the contractor, all

location and limit marks reasonably necessary as provided in Paragraph 1-22. The inspectors will keep a record of work done, and see that the location and limit marks are kept in proper order; work done without proper inspection may not be paid for. The presence of an inspector shall not relieve the contractor of his responsibility for the superintendence required in the proper execution of the work (see Article 8 of the contract). Tests to determine the quality and fitness of material used and work done under these specifications will be made as indicated under that part of the specifications pertinent to the particular kind of work, and as stated in Paragraph 1-37.

b. Facilities to be furnished. - (1) The contractor shall furnish promptly, in accordance with Article 6 of the contract, all reasonable facilities, labor, and materials necessary for the safe and convenient inspection and tests that may be required by the contracting officer and his inspectors.

(2) The contractor shall furnish an appropriate room, approximately 12 x 20 feet in size, at his concrete mixing plant for a Government laboratory, to be used for making field tests including the moisture content of aggregates and such other field tests as are prescribed in these specifications under Section X and for temporary storage of concrete specimens. The room shall be protected from the weather, properly lighted, and heated, all of which together with the location and capacity will be subject to the approval of the contracting officer. The contractor shall provide electricity in accordance with Paragraph 1-34.

(3) The contractor shall furnish appropriate quarters for a Government field office. Such quarters may be a room approximately 12 x 20 feet in size, and otherwise shall conform to the provisions of subparagraph (2) above.

(4) No separate payment will be made to the contractor for providing these facilities. Should the contractor refuse, neglect, or delay compliance with the requirements concerning facilities for inspection and for the Government field office, the specific facilities may be furnished and maintained by the Government, and the cost therefor will be deducted from any amounts due or to become due the contractor.

c. It is hereby understood and agreed that any instructions or decisions by a superior officer through the contracting officer are to be considered instructions or decisions of the contracting officer in all cases under the terms of the contract where decision rests with the contracting officer.

1-21. Datum and bench marks. - The plane of reference used in these specifications and on the drawings hereof is mean sea level datum. Elevations in feet as specified and as shown on the drawings are to be determined from bench marks located at the site of the work, the locations, descriptions, and elevations (in feet) of which are as follows:

A U.S.G.S. Bench Mark

T-8 at East Hartford, Hartford County, on the N.Y. N.H. and H. R.R., 294 feet east of the station, at the bridge over Main St., in the top of the south end of the west abutment, and 29 feet south of the south rail. A standard disk, stamped "T8 45.33."

(13.769 meters or 45.174 feet)

1-22. Lines and grades. - a. The contractor shall keep the contracting officer informed a reasonable time in advance of the time and places at which he intends to do work in order that lines and grades may be given, necessary measurements for record and payment made and progress photographs taken with a minimum of inconvenience to the contracting officer or of delay to the contractor, and the contractor shall have no claim for damages or extension of time on account of delays in the giving of lines and grades or due to destruction of such marks and the consequent necessity for replacement. Whenever the contracting officer finds it necessary to carry on his operations on Sundays, legal holidays or at other times when the work of the contractor is not in progress, the contractor shall furnish all necessary service and assistance. No direct compensation will be made for the cost to the contractor for any of the work or delay occasioned by giving lines and grades or making other necessary measurements or by inspection, but compensation shall be considered as having been included in the contract prices.

b. All lines and grades will be given by the Government inspectors as authorized representatives of the contracting officer, but the contractor shall provide at his own expense such temporary structures and such materials and give such assistance as may be required by the contracting officer and the marks given shall be carefully preserved. After lines, elevations and grades for any part of the work have been given by the contracting officer, the contractor will be held responsible for the proper execution of the work to such lines, elevations, and grades, and all stakes or other marks given shall be preserved by the contractor until they are authorized to be removed by the contracting officer. The contracting officer may require the work to be suspended when for any reason such marks cannot be properly followed.

1-23. Interpretation of specifications. - The contracting officer shall decide all questions which may arise as to the performance, quantity, quality, acceptability, fitness, and rate of progress of the several kinds of work to be done or materials to be furnished under this contract. He shall decide all questions which may arise as to the interpretation of the specifications and of drawings used and as to the fulfillment of this contract on the part of the contractor, and as to defects in the contractor's work. His determination and decision shall be final, subject to appeal as provided for in Article 15 of the contract.

1-24. Borrow areas. - a. Borrow areas will be furnished by the local interests without cost to the contractor, including rights of way for transportation purposes across property not owned. If sufficient material is not available in the borrow areas indicated on the drawings or otherwise provided to complete the work, additional areas will be furnished without cost to the contractor.

b. The contractor shall inform the contracting officer of the locations in the borrow areas in which he intends to work. He shall inform the contracting officer a sufficient time in advance so that the contracting officer can make additional investigations of the materials without delay to the contractor. The contractor shall furnish all labor and construction equipment that is necessary to prepare for taking the samples and shall furnish labor to assist the contracting officer to take the samples.

1-25. Water supply. - The contractor shall provide, at convenient points, ample supplies of water of proper quality for all the operations required under this contract.

1-26. Use of explosives. - The contractor shall use the utmost care in the use of explosives necessary for the prosecution of the work, not to endanger life or property. All blasting operations shall be conducted by experienced men only. The handling and use of explosives shall be done strictly in accordance with the latest methods and rulings to insure safety; in accordance with the specifications issued by the U. S. Bureau of Mines; and in compliance with the local and State laws. Failure to observe necessary precautions will be sufficient grounds for temporary suspension of the work. All explosives shall be transported and stored in a secure manner, and in accordance with local and State laws; all vehicles and such storage places shall be marked clearly "DANGEROUS - EXPLOSIVES," and be in care of competent watchmen at all times. In no case shall caps or other detonators be stored or transported with dynamite or other explosives. The locations of magazines for the storage of explosives and for the separate storage of detonators shall be subject to the approval of the contracting officer.

1-27. Standard stock products. - All material, supplies and articles furnished shall, wherever so specified and otherwise wherever practicable, be the standard stock products of recognized reputable manufacturers. The standard stock products of manufacturers other than those specified will be accepted if, in the opinion of the contracting officer, they are equal in strength, durability, usefulness and convenience for the purpose intended. (See Article 7 of the contract.) Any changes required in the details and dimensions shown on the drawings for the substitution of standard stock products, other than those provided for, shall be properly made as approved by the contracting officer, and at the expense of the contractor.

1-28. Safety requirements. - a. The contractor shall make all necessary provisions to protect the public safety, and to maintain and protect existing structures of whatever kind, and shall repair all damages done to such structures. He shall give ample notification to the proper

officials of any city or twon and of any city or town and of any public utility or other corporation before entering upon their respective public ways or rights of way to perform the required work of construction. Such construction shall conform to the customary regulations and requirements of said officials or corporations. The contractor shall give all notices, take out all permits, and pay all such charges, fees, water and other rates that may be necessary in the carrying out of the work.

b. The contractor shall be responsible that his employees strictly observe the laws of the United States affecting all operations at the site under the contract. He shall comply with all applicable Federal and State laws under which he is operating, including those concerning the inspection of boilers and other equipment, the licensing of engineers, welders and other employees.

c. The contractor shall conduct the work with due regard to adequate safety and sanitary requirements and shall maintain his plant and equipment in safe condition. He shall conform to current safety engineering practices as set forth in the Manual of Accident Prevention in Construction, published by the Associated General Contractors of America; the publications of the National Safety Council, and with all applicable State or local safety and sanitary laws, regulations and ordinances.

d. The contracting officer will require such safety and sanitary measures to be taken as the nature of the work and the conditions under which it is to be performed, demand. Such measures shall include:

(1) The provision of adequate extinguishers or fire-fighting apparatus in and about all buildings and plant erected or used at the site of the work.

(2) Adequate first aid and life-saving equipment.

(3) Adequate illumination during night operations.

(4) Instruction in accident prevention to reach all employees.

(5) Such machinery guards, safe walkways, scaffolds, ladders, bridges, gang-planks, and other safety devices, equipment, and apparel as are necessary to prevent accidents or injuries.

e. The contractor shall promptly report to the contracting officer in form prescribed by him all accidents occuring at the site of the work.

f. The contracting officer will notify the contractor in writing of any non-compliance with the foregoing provisions and the corrective action to be taken. If the contractor fails or refuses to comply promptly the contracting officer may issue a stop order suspending all or any part of the work. Such stop order will be sent by registered mail to the con-

tractor at the site of the work and shall be accepted by him as sufficient notice thereof. Work shall thereupon be suspended as directed. When satisfactory corrective action is taken, a resumption order will be issued. No part of the time lost due to any such stop order shall be made the subject of a claim for extension of time or for excess costs or damages by the contractor.

1-29. Access to work. - The contracting officer, his authorized representative and other duly authorized agents and employees of the Government may at all times enter upon the work and premises used by the contractor, or into his works, or shops. The contractor shall provide safe and proper facilities for such entrance and for the inspection of materials and workmanship.

1-30. Special wage and labor provisions pertaining to persons employed under the provisions of the Emergency Relief Appropriation Act of 1938. - a. Employment of relief labor. - The contractor shall plan his work, and the use of machinery and equipment thereon, so as to provide the maximum employment of relief labor. Relief labor shall be employed as uniformly through the contract period as the status of the work will permit, in the opinion of the contracting officer. Except with the specific authorization of the Federal Works Progress Administratoror or his representative, at least 95 per cent of the workers paid from Emergency Relief funds shall be referred for assignment to the work by such relief agency as may be designated by the Federal Works Progress Administrator or his representative.

b. Labor preferences. - (1) Preference for employment shall be given to persons certified as in need of relief by the public relief agency approved by the Works Progress Administration.

(2) No such person under the age of eighteen (18) years, nor one whose age or physical condition is such as to make his employment dangerous to his health or safety, or the health and safety of others, may be employed under these funds. This paragraph shall not be construed to operate against the employment of physically handicapped persons, otherwise employable, where such persons may be safely assigned to work which they can ably perform.

(3) Only one such member of a family group may be employed under these funds, except as specifically authorized by the Works Progress Administration.

(4) No alien is eligible for employment under the W.P.A. program even though he may have declared his intentions to become a citizen of the United States.

(5) From among those persons certified as in need of relief who are qualified by training, experience and ability, preference in employment shall be given in the following order: (1) Veterans of the World War and the Spanish-American War and veterans of any campaign or

expedition in which the United States has been engaged (as determined on the basis of the laws administered by the Veterans' Administration) who are in need and are American citizens; (2) other American citizens, Indians and other persons owing allegiance to the United States who are in need.

(6) Except as specifically provided above, such workers who are qualified by training and experience and certified for work on the project by such agency as may be designated by the Federal Administrator of the Works Progress Administration, shall not be discriminated against on any grounds whatsoever.

(7) The contractor shall maintain an up-to-date roster of all employees engaged on the project, showing their names, legal residences, and sources of employment.

c. Wages and monthly earnings. - (1) The contractor and all subcontractors shall pay all such employees directly employed on this work at the site thereof an hourly rate of pay which shall not be less than the minimum hourly rate of pay as specified in Paragraph 1-35. "The site of the work" as used in these specifications shall include all operations under this contract or any subcontract, involving labor and materials or labor only, regardless of location, except that operations that are part of the usual and current business of the executor and mingled with other similar work not under this contract shall not be so included. For example, the work of supplying sand and gravel from a pit that is opened up and manned solely for work under this contract is an operation directly on the work. Project employees paid on an hourly basis shall be compensated only for time actually worked except wherever project employee is paid for a day on which a compensable injury occurs.

(2) At least 95 per cent of such employees shall be paid in accordance with the Schedule of Monthly Earnings established by Executive Order No. 7046, dated May 20, 1935, or subsequent revisions thereof, except with the specific authorization of the Federal Works Progress Administrator or his designated representative (see subparagraph (5)).

(3) A clearly legible statement of all wage rates to be paid the several classes of such labor employed on the work shall be posted in a prominent and easily accessible place at the site of the work, and the contractor shall keep a true and accurate record of the hours worked by and the wages paid to each such employee and shall furnish the contracting officer with a sworn statement thereof on demand. All such employees shall be paid in full not less often than once each week and in lawful money of the United States in the full amount accrued to each individual at the time of closing of the payroll, which shall be at the latest date practicable prior to the date of payment, and there shall be no deductions or rebates on account of goods purchased, rent, or other obligations, but such obligations shall be subject to collection only by legal process.

(4) Wages for any such employees to be paid by, or for which reimbursement is to be made by, the Federal Government may not be pledged or assigned, and any purported pledge or assignment shall be null and void.

(5) The following Schedule of Monthly Earnings is applicable to relief work under this contract (subject to authorized revisions and modifications):

Designation	Hours to be Worked Monthly	Maximum Monthly Earnings	Computed Hourly Rate
Blacksmiths	93	$93.00	$ 1.00
Bricklayers	74	92.50	1.25
Carpenters	83	93.38	1.12-1/2
Cutters, acetylene	84	71.40	.85
Deckhands (dredge)	109	59.95	.55
Electrical workers (outside)	83	93.38	1.12-1/2
Firemen, under 15 lbs. pressure	119	71.40	.60
Firemen, 15 lbs. pressure and over	116	92.80	.80
Jackhammer men	*	*	
Laborers, common	120	60.00	.50
Levermen (hydraulic dredge)	(Hours and earnings not restricted)		
Mason tenders	95	71.25	.75
Mechanics (repairmen)	*	*	
Operators of power equipment:			
Air compressors	110	71.50	.65
Concrete mixers, 5 bags or over	84	71.40	.85
Concrete mixers, under 5 bags	119	71.40	.60
Cranes, derricks, draglines	62	93.00	1.50
Pumps	119	71.40	.60
Shovels (1/2 cu. yd. or less)	71	92.30	1.30
Shovels (5/8 cu. yd. or more)	62	93.00	1.50
Tractors	95	71.25	.75
Reinforcing rod setters	*	*	
Structural iron workers	56	92.40	1.65
Truck drivers, 2 tons or under	119	71.40	.60
Truck drivers, over 2 tons	110	71.50	.65

* Will be furnished by addendum later, if the information becomes available.

(6) The normal hours of work for certified employeed shall be that number of hours required to earn the authorized monthly wage at the established rate of pay.

d. Delays - damages. - Any deficiency in the supply of suitably qualified labor to be referred to the work by such agency as may be designated by the Federal Works Progress Administrator may constitute a basis for demand for the modification of this contract as provided in Article 9 as being an "Act of the Government."

e. Compensation insurance. - The contractor shall provide adequate workmen's compensation insurance for all such labor that may come within the protection of such laws and shall provide, where practicable, employers' general liability insurance for the benefit of his employees not protected by such compensation laws, and proof of such insurance satisfactory to the contracting officer shall be given.

f. Dismissal of employees. - Every employer of such persons may dismiss any such employees only with the approval of the contracting officer.

g. Copies of payrolls. - The contractor shall furnish the contracting officer's representative on the work certified legible copies of payrolls, not later than the third day following the payment of wages, for all persons employed by the contractor and each subcontractor at the site of the work as follows:

(1) Two copies of payrolls for all persons assigned through the Works Progress Administration on forms prescribed by the Works Progress Administration. These forms will be supplied by the contracting officer.

(2) Two copies of payrolls for all other employees at the site of the work. These rolls may be prepared on forms regularly in use by the contractor and subcontractors.

h. Subcontractors. - The contractor shall cause appropriate provisions to be inserted in all subcontracts relating to this work for which payment is to be made from funds appropriated by the Emergency Relief Appropriation Act of 1938 to insure the fulfillment of all the provisions contained herein applicable to such funds.

1-31. Purchase of supplies and materials. - a. Preference for domestic articles. - (1) Because the materials listed below or the materials from which they are manufactured are not mined, produced, or manufactured, as the case may be, in the United States in sufficient and reasonably available commercial quantities and of a satisfactory quality, their use in the work herein specified (subject to the requirements of the specifications) is authorized without regard to the country of origin.

Platinum	Rubber	Balsa wood
Chromium	Teakwood	English ball clay
Cork	Sisal	English china clay
Jute	Silk	Natural copper-nickel alloy (monel metal)
Kauri gum	Tin	
Lac	Asbestos	
Nickel	China wood oil	

(2) Articles, materials, or supplies, manufactured in the United States and containing mercury, antimony, tungsten, or mica of foreign origin may be used (subject to the requirements of the specifications) in the work herein specified, because such manufactured articles, materials, or supplies have been manufactured in the United States substantially all from articles, materials, or supplies mined, produced, or manufactured, as the case may be, in the United States.

b. Purchasing procedure. - Two copies of all purchase orders showing firm names and addresses, and of all shipping bills or

memoranda of shipments received showing car initials and numbers, when shipped by railroad, shall be furnished promptly to the contracting officer. Such orders, shipping bills or memoranda shall clearly indicate weights, and shall be so worded or marked that each item piece or member can be definitely identified on the drawings.

1-32. Minor modifications. - The right is reserved to make such minor changes in the execution of the work to be done under these specifications as, in the judgment of the contracting officer, may be necessary or expedient to carry out the intent of the contract; provided that the unit cost to the contractor of doing the work shall not be increased thereby, and no increase in unit price over the contract rate will be paid to the contractor on account of such changes.

1-33. Protests and appeals. - The Chief of Engineers has been designated by the Secretary of War as his duly authorized representative to make final decision, and to take other action where the terms of the contract require that such decision or action shall rest with the "head of the department concerned or his duly authorized representative." If the contractor considers any work required of him to be outside the requirements of the contract, or if he considers unfair any action or ruling of the inspectors or contracting officer, he shall ask for written instruction or decision from the contracting officer immediately. Any protest based upon such instructions or decision, or claim otherwise arising under the contract, including a request for extension of time under Article 9 of the contract, shall be submitted to the contracting officer within the period specified in the contract. If the contractor is not satisfied with the ruling of the contracting officer he may, where appeal is stipulated in the contract, make written appeal to the Chief of Engineers. Such appeals, containing all the facts and circumstances upon which the contractor bases his claim for relief, shall be addressed to the Chief of Engineers, United States Army, and presented to the contracting officer for transmittal within the time provided therefor in the contract.

1-34. Electric power to be furnished by the contractor. - The contractor shall make arrangements for, shall pay for, and furnish all necessary power to carry on the work, including sufficient power for lighting and other miscellaneous uses in buildings furnished by the contractor for Government use. No separate payment will be made to the contractor for the power furnished.

1-35. Rate of wages. - a. In accordance with Article 17 of the contract, the minimum wages shown in the following schedule, as approved by the United States Department of Labor, shall be the minimum rates of wages to be paid by the contractor for work under this contract. Corresponding rates for occupations not listed below will be furnished upon application by the contractor.

Designation	Wage Rate - Hourly
Blacksmiths	$ 1.00
Bricklayers	1.25
Carpenters	1.00
Cutters, acetylene	.85
Deckhands (dredge)	.55
Electrical workers (outside)	1.125
Firemen, under 15 lbs. pressure	.60
Firemen, 15 lbs. pressure and over	.80
Jackhammer men	.65
Laborers, common	.50
Levermen (hydraulic dredge)	1.125
Mason tenders	.75
Mechanics (repairmen)	1.00
Operators of power equipment:	
Air compressors	.65
Concrete mixers, 5 bags or over	.85
Concrete mixers, under 5 bags	.60
Cranes, derricks, draglines	1.50
Pumps	.60
Shovels (1/2 c.y. or less)	1.30
Shovels (5/8 c.y. or more)	1.50
Tractors	.75
Reinforcing rod setters	1.30
Structural iron workers	1.65
Truck drivers, 2 tons or under	.60
Truck drivers, over 2 tons	.65

b. Any class of laborers and mechanics not listed above, which will be employed on the work, will be classified or reclassified by the contracting officer to conform to the foregoing schedule. In the event of disagreement between the contracting officer and the contractor as to such classification or reclassification, the question, accompanied by the recommendation of the contracting officer, will be referred to the United States Department of Labor for final determination.

c. The above list of wages shall be posted by the contractor in a conspicuous place on the work.

1-36. Reports to Department of Labor. - The contractor shall report monthly, and shall cause all subcontractors to report in like manner, within 5 days after the close of each calendar month, on forms to be furnished by the Department of Labor, the number of persons on their respective payrolls, the aggregate amount of such payrolls, the man-hours worked, and the total expenditures for materials. He shall furnish to the Department of Labor the names and addresses of all subcontractors on the work at the earliest date practicable, provided that the foregoing shall be applicable only to work at the site of the construction project.

1-37. Standard tests, qualities and guarantees. - a. All materials, supplies and parts and assemblies thereof, entering into the work to be

done under these specifications, shall be tested as specified, or otherwise required, in conformity with the best modern approved methods for the particular type and class of work.

b. Unless waived in writing by the contracting officer, all tests and trials shall be made in the presence of a duly authorized representative of the contracting officer. When the presence of the inspector is so waived, sworn statements, in duplicate, of the tests made and the results thereof, shall be furnished to the contracting officer by the contractor.

c. Costs of all tests and trials, excepting the expense of the Government inspector and cement, concrete aggregate and cylinder tests, and tests on embankment materials, shall be borne by the contractor and shall be included in the contract price. (See Paragraph 10-11.)

d. All materials, parts and equipment shall be of the highest grade, free from defects and imperfections, of recent manufacture, new and unused. Workmanship shall be of the highest grade and in accordance with the best modern standard practice.

1-38. Protection of existing structures. - During construction operations, on work covered by these specifications, the contractor shall protect all existing structures and accepted work. Any disturbances or damage to any structures by operations under these specifications shall be repaired promptly by the contractor without cost to the Government.

1-39. Final acceptance and payment. - As soon as practicable after the completion of any section of the work as in the opinion of the contracting officer will not be subject to injury by further operations under these specifications, such section may be examined as deemed advisable by the contracting officer. The contracting officer will make a thorough examination of same and if it is found to comply fully with the requirements of the specifications, it will be accepted, and final payment will be made in accordance with Article 16 of the contract.

1-40. Approval. - This contract will be subject to the written approval of the Division Engineer, North Atlantic Division, Engineer Department, United States Army, and shall not be binding until so approved.

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SECTION II. PREPARATION OF SITE (Item 1)

2-01. Work included. - a. Clearing, grubbing, removal of marine railways, and disposal of materials shall be done as directed by the contracting officer, within the limits shown on the drawings or as staked in the field.

b. No work will be required under this contract north of Connecticut Boulevard, except the removal of the marine railway at Jencks Street.

2-02. Clearing. - a. The areas to be cleared shall include: (1) the area within the limits of the foundation of the required earth dike, together with a 5-foot strip measured horizontally beyond and contiguous to the toe line on each side of the dike and ramps, (2) borrow areas, (3) the areas within the limits of the foundation of the required concrete flood wall or other proposed structures, and (4) any other area designated by the contracting officer within the limits shown on the drawings.

b. Trees and other obstructions shall be removed by the contractor from the sites of the proposed structures and of the borrow areas when and as directed by the contracting officer and may be removed from other areas only to the extent directed or permitted. The contractor shall preserve and protect from injury all trees not required to be removed.

c. All timber, undergrowth, brush, logs, weeds, and debris of any nature, which in the opinion of the contracting officer are unsuitable for the foundation of the dike and flood wall, shall be removed to such depths and limits as directed by the contracting officer.

2-03. Grubbing. - a. The areas to be grubbed shall include the areas previously cleared, as may be directed by the contracting officer.

b. All such areas shall be thoroughly grubbed of all stumps, roots, buried logs, and other objectionable matter. Tap roots and other projections over 1-1/2 inches in diameter within the limits of the dike and flood wall foundations shall be grubbed out to a depth at least 3 feet below the ground surface, unless otherwise directed by the contracting officer. Old road beds within the limits of the right of way shall be thoroughly broken up and all surfacing and base courses of the pavements shall be removed as directed by the contracting officer.

2-04. Removal of structures. - a. The contractor shall remove fences to the limits of the right of way and shall store them. After completion of the construction work, the contractor shall rebuild the fences to the toe of the dike as directed by the contracting officer.

b. The removal of existing structures and utilities required to permit the orderly prosecution of the work covered by these specifications will be accomplished by local agencies. Whenever a telephone or

telegraph pole, pipe line, conduit, sewer or other utility is encountered which must be removed to permit completion of the work, the contracting officer will notify the proper local authorities, and the designated utility will be promptly removed. The work specified under Items 10 and 35 is excepted (see Paragraphs 4-09 and 9-03).

c. The contractor shall remove three marine railways located at Stations 109+00, 152+70 and 154+80 as shown on the drawings. Each railway consists of two 25-pound rails, spiked to 6" x 8" x 6'-0" cross-ties spaced about two feet apart. The rails and ties shall be removed from the area within the limits of the dike, and the rails shall be stored near the site of the work as directed by the contracting officer.

2-05. Disposal of materials. - All materials removed, as specified above, shall be disposed of by burning or by removal to approved disposal areas as directed. No material shall be thrown into, or left along the bank of, the river. The disposal of material shall closely follow the operations of clearing and grubbing so that brush and other debris will not be washed into the river in case of high water. At no time shall material be placed on land adjacent to the construction area. No damage of any nature shall be inflicted upon adjoining property owners by unwarranted entry or disposal of material on adjacent property.

2-06. Measurement and payment. - The quantity to be paid for under Item 1 will be the number of acres cleared and grubbed. Payment for all work in connection with the preparation of the site as above specified, including the loading, hauling and disposal of the materials, will be made at the contract unit price for Item 1, "Preparation of Site."

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SECTION III. CARE AND DIVERSION OF WATER AND SEWAGE (Item 2).

3-01. Work included. - a. - The contractor shall protect the permanent construction and divert the water in the Connecticut River away from conduit and sewer outfalls at the locations required by the work as directed by the contracting officer. The contractor shall construct all permanent work in areas free from water unless otherwise authorized by the contracting officer. Necessary shoring, sheeting and pumping, and clearances for the permanent work shall be provided for (see Paragraphs 4-05 and 4-08).

b. The contractor shall maintain existing operating sewers during construction, and shall divert the sewage away from the permanent construction directly into the Connecticut River (see Paragraph 1-28c). Necessary temporary additions to the existing sewer system shall be provided.

3-02. Cofferdam protection. - Any type of diversion cofferdam may be used, subject to the approval of the contracting officer. The diversion cofferdam shall be located so as to provide adequate clearances around the permanent work, and shall be built to such height and section as may be adequate to protect the permanent work. The contractor shall be responsible for the adequacy of the cofferdam protection, and for any damage resulting from failure or washing out of cofferdams. Subject to the approval of the contracting officer, materials excavated from borrow pits or other parts of the work shown on the drawings may be used for constructing cofferdams.

3-03. Maintaining existing sewers. - Provisions shall be made to maintain the satisfactory operation of existing sewers throughout the construction period, unless otherwise authorized by the contracting officer. The contractor shall install temporary sewer extensions and connections, including valves and specials, necessary to divert the sewage away from the permanent work. The temporary sewer extensions shall be installed in conformity with the provisions of Section IX applying to tile pipe, of the same size as the existing sewer to which connection is made, unless otherwise shown on the drawings or directed by the contracting officer. The installation of temporary sewer extensions and connections shall include all shoring, excavation, backfilling and other incidental work required in connection therewith.

3-04. Pumping and draining. - Before beginning work within the cofferdams, the construction areas shall be unwatered, and the sewage diverted, and shall be kept free from water and sewage throughout the working period, unless otherwise authorized by the contracting officer.

3-05. Removal of cofferdams and temporary sewer connections. - When the work is finished within the cofferdams or when the need for the cofferdams and temporary sewer connections no longer exists, the cofferdams and temporary sewer connections shall be removed as directed by the contracting

officer. Care shall be taken that there shall be no obstruction to the discharge from the new conduit or sewer outfalls.

3-06. Payment. - The contract price for Item 2 shall include payment for care and diversion of water and sewage during construction, the construction, maintenance, rebuilding in case of destruction, unwatering and removal of cofferdams and temporary sewer connections, and maintenance of unobstructed flow through the existing sewers encountered in the work. Payment will be made in one sum at the contract price for Item 2 when, in the opinion of the contracting officer, the permanent construction no longer requires the protective measures specified under Item 2.

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SECTION IV. EXCAVATION (Items 3 to 10 incl.)

4-01. Classification. - All materials excavated will be classified as follows:

a. Common excavation shall include all earth, clay, sand, gravel, and topsoil as defined below, also such hard and compact materials as hardpan, cemented gravel, shale and soft or disintegrated rock that can be removed by hand, power shovels, or draglines without continuous and systematic blasting, and also boulders and detached pieces of solid rock less than 1/2 cubic yard in volume.

b. The words "soil" or "topsoil" shall mean the material composing the surface layers of the ground containing varying amounts of organic matter.

c. Detailed classification is as follows:

(1) Stripping (Item 3) (see Paragraph 4-04).

(2) Common excavation (see Paragraphs 4-05, 4-06, 4-07 and 4-08.)

General (Item 4).

Borrow Area (Items 5, 6, 7, & 7A).

Cut-off Trench (Item 8).

Sewer Trench (Item 9).

(3) Removal of masonry, structures and foundations (Item 10) (see Paragraph 4-09).

4-02. Measurement. - Prior to the commencement of work under this contract, a survey of the site and borrow areas of the specified work will be made and the surface as determined by this survey will form the basis for the measurement of all quantities. All stripping and excavation quantities will be measured between the surfaces determined by this survey and the slope and grade lines shown on the drawings or established by the contracting officer. The slope lines shown on the drawings may not represent the actual slopes to which the excavation must be made to safely perfor the work; the actual slopes may be greater or less than those indicated, depending upon the materials excavated and methods used in performing the work, but such changes will not alter the basis of measurement as specified above. No payment will be made for excavation outside of the limits described above; the contractor will be required to backfill any such excess excavation with approved material, or with concrete where excavated surfaces are in contact with concrete structures, at his own expense.

4-03. Disposal of materials. - The contractor shall deposit suitable excavated materials in the required embankments as directed by the contracting officer, and shall waste in spoil areas in approved locations materials from the excavation that are unacceptable for use in the embankments as directed by the contracting officer. Materials, if any, which cannot be placed at once in permanent positions, may be deposited in storage piles at locations designated. The materials to be excavated from such storage piles will not again be paid for as excavation.

4-04. Stripping. (Item 3). - a. Work included. - (1) The contractor shall strip the area to be covered by the earth dike to a sufficient depth to remove all material not suitable for the foundation of the dike as directed by the contracting officer. Stripping in the area north of the Connecticut Boulevard is now carried on by Government hired labor operations. It is expected that practically all of this area will be stripped before the contractor will proceed. The unsuitable materials to be removed shall include sod, topsoil, rubbish below the ground surface not removed by clearing and grubbing, all loose, weathered, or otherwise unsatisfactory rock and any other objectionable material.

(2) Topsoil and sod obtained from the stripping operations shall be stock-piled in an approved location to be used later in dressing earth dike slopes, unless otherwise authorized by the contracting officer.

b. Disposal of materials. - The provisions of Paragraph 4-03 shall apply.

c. Measurement and payment. - Measurement will be in accordance with Paragraph 4-02. Payment for all work in connection with stripping, including the loading, hauling, disposal of the materials, and any rehandling required, will be made by the cubic yard under Item 3, "Stripping".

4-05. Common excavation - general (Item 4). - a. Work included. - The contractor shall excavate and dispose of the materials classified as common excavation above and below the mean water level in the river to the lines and grades shown on the drawings for the respective areas, or as otherwise directed by the contracting officer. Excavation shall be performed in accordance with a schedule of operations to be approved by the contracting officer. Common excavation includes excavation for the foundation of the earth dike additional to that included under Items 1 and 3, excavation for the toe drain, and any other required common excavation for structures, drains and ditches not included in other items of the work.

b. Description. - Excavations shall be made wide enough to permit proper sheeting, bracing and form work where necessary.

c. Shoring. - The contractor shall be responsible for the unfinished work, and that workmen shall be safe from danger of caving or slides while making structure excavations. Shoring may be used at the option of the contractor. If shoring is necessary and the contractor does not use it, its use will be ordered by the contracting officer. Shoring

shall be removed upon completion of the permanent work or as soon as the construction does not require its use. Where shoring is used in excavation for structures in lieu of excavation to full dimensions of the payment lines, an estimate for excavation will be made as though the cut had been made to the payment lines indicated on the drawings. No separate payment will be made for shoring as such, but all costs thereof shall be included in the cost of excavation.

d. Sheeting and pumping. - (1) The contractor shall provide all labor and materials wherever necessary to enclose the proposed work by temporary cofferdams or otherwise, so as to excavate to the depth and lines shown on the drawings (see Section III). Subject to the approval of the contracting officer, sheeting shall be so constructed and carried to such depth as to prevent excessive inflow of water and intrusion of sand and other materials into the area being excavated.

(2) The contractor shall provide all necessary pumps to unwater the site properly and to keep the site free of water during such time as the work is under construction. The contractor shall provide all labor and materials required to keep the site unwatered during the course of construction, and shall provide all necessary bulkheads, drains, etc., to prevent running water from coming in contact with newly placed concrete or concrete being placed in excavated areas.

e. Disposal of materials. - The provisions of Paragraph 4-03 shall apply.

f. Measurement and payment. - See Paragraph 4-07d.

4-06. Common excavation - borrow areas. (Items 5, 6, 7, and 7A). - a. Work included. - Under Items 5, 6, 7, and 7A, the contractor shall excavate in the indicated borrow areas or other approved areas, the materials to be used in the dike or miscellaneous fills. Payment for excavation shall include the cost of loading and transporting the material to the point of disposal. Borrow excavation shall include the stripping of the areas and disposal of objectionable topsoil containing roots or other debris, and the removal and the disposal of any other objectionable matter so designated by the contracting officer. To provide suitable fill materials excavations shall be made to the depths and in the locations as directed by the contracting officer. During and after excavation the borrow areas shall be graded so that all surface water will drain readily from them. The borrow areas shall be dressed smoothly and evenly, left in a neat condition satisfactory to the contracting officer, and shall be graded so that the slopes blend into the surrounding topography.

b. Description. (1) Under Items 5, 6, 7, and 7A shall be included the excavation from the borrow areas as shown on the drawings. The limit of excavation in the vicinity of the earth dike shall be that shown on the drawings or expressly directed by the contracting officer. No borrow excavations will be permitted within 500 feet of the toes of the dike. The limits of dredging of pervious material shall be as shown on the

drawings or directed by the contracting officer (see Paragraph 6-03b(2)).

(2) Under Item 6, excavation from borrow area "C" may be prohibited at times because of the high water content of the material, which would make it unsuitable for use in the impervious section of the dike. Previous flooding by the river of borrow area "C" will prohibit the use of material from this area until such use is authorized by the contracting officer.

(3) Under Item 7, case shall be taken to dredge only approved pervious and random material. Provision shall be made to by-pass from the discharge pipe any clay or other unsuitable material that may be encountered in the dredging operations. Unsatisfactory materials such as large stones, clay chunks, wood or other debris shall be removed or otherwise disposed of as directed by the contracting officer. Suitable provision shall be made for draining water from the stockpiles back to the river, with a minimum loss of approved material. The material may be stockpiled. After it has dried out sufficiently so that the moisture content is satisfactory in the opinion of the contracting officer (see Paragraph 6-06c), the approved pervious or random material shall be placed in the embankment section in accordance with the applicable provisions of Paragraph 6-06b.

(4) Under Item 7A, the provisions of subparagraph (3) above shall apply, except that the material shall be dredged directly to its final position in the embankment. The discharge pipe shall be located at the landside face of the embankment to secure a suitable gradation of material as directed by the contracting officer, with the coarser material adjacent to the landside face of the embankment. The construction operations shall insure that the dredged material shall be placed to line and grade in approximately 12-inch layers, for the full width of the pervious and random sections of the embankment as directed by the contracting officer, and for a length of embankment section not exceeding 300 feet unless otherwise directed by the contracting officer. Sufficient baffle-boards or other means shall be used to control the operation. Caterpillar bulldozers shall be employed on the embankment to spread the dredged material in order to distribute evenly the various grades of materials and avoid uneven segregation. Suitable provisions shall be made for draining water back to the river with a minimum loss of approved material, and with no gullying or washing of any portion of the constructed embankment. Successive 12-inch layers of material shall be placed as directed by the contracting officer for as much of the full height of the pervious and random sections of the embankment as may be practicable in the opinion of the contracting officer. The material required for the remainder of the pervious and random sections of the embankment shall be excavated and rehandled as required for work under Item 7 according to the provisions of subparagraph (3) above. Payment will be made at the unit contract price for Item 7A for the quantity satisfactorily placed in the embankment sections by hydraulic methods and measured in place in the embankment (see Paragraph 4-07d(3)), and shall include all costs of excavating and transporting the material to the embankment (see Paragraphs 6-03b(2) and 6-06a(2)).

c. Disposal of materials. - The provisions of Paragraph 4-03 shall apply, unless otherwise specified (see Paragraph 4-06b(4)).

d. Measurement and payment. - See Paragraph 4-07d.

4-07. Common excavation - cut-off trench (Item 8). - a. Work included. - The contractor shall excavate and dispose of the materials in the cut-off trench for the earth dike, both above and below the mean water level in the river to the lines and grades shown on the drawings, or as otherwise directed by the contracting officer. The required depth of the cut-off trench at all points cannot be known with certainty until the area is fully developed by the construction operations. The lines and grades shall include any necessary adjustment to field conditions.

b. Pumping and draining. - The contractor shall do all pumping and draining necessary to perform the excavation in the dry, unless otherwise directed by the contracting officer, and to keep the cut-off trench unwatered until it has been satisfactorily backfilled with suitable material.

c. Disposal of materials. - The provisions of Paragraph 4-03 shall apply.

d. Measurement and payment. - (1) Measurement for excavation work under Items 4 to 8, inclusive, will be made in accordance with Paragraph 4-02, except as otherwise provided for in sub-paragraphs (2) and (3) below. Payment for all work in connection with excavation under Items 4 to 8, inclusive, including the loading, hauling, disposal of the materials, and all other incidental work required, will be made at the applicable contract unit prices for Items 4, 5, 6, 7, 7A and 8.

(2) If, in the opinion of the contracting officer, it is impracticable to measure the volume of excavation under Item 7 in accordance with Paragraph 4-02, because of partial refilling of the excavated area by the river, then the measurement for excavation work under Item 7 will be the volume of the pervious and random sections satisfactorily placed in embankment to the lines and grades shown on the drawings or staked in the field, plus 15 per cent of such volume to allow for unsuitable material wasted as directed by the contracting officer.

(3) For Item 7A, payment will be made at the unit contract price for the quantity of material measured in embankment to the lines and grades shown on the drawings or staked in the field (see Paragraph 4-06b(4)).

4-08. Common excavation - sewer trench (Item 9.). - a. Work included. - The contractor shall excavate and dispose of the materials in the trenches required for culverts and sewers under the dike as shown on the drawings. The contractor shall excavate and dispose of the materials in trenches required for connecting sewers and pipe drains as shown on the drawings.

b. Description. - (1) Excavation shall be performed in accordance with a schedule of operations to be approved by the contracting officer. The work shall be commenced at the lowest point and shall progress upgrade as directed. Excavations shall be made to the lines and grades shown on the drawings, with vertical sides unless otherwise directed by the contracting officer, and wide enough to permit proper shoring, sheeting and bracing (see Paragraph 9-02b(1)).

(2) Provisions shall be made for the care and diversion of water and sewage and for the maintenance of operating sewers during construction (see Section III).

c. Shoring. - The provisions of Paragraph 4-05c shall apply.

d. Sheeting and pumping. - The provisions of Paragraph 4-05d shall apply.

e. Disposal of materials. - All suitable materials excavated under Item 9 shall be used as backfill for the trench (see Paragraphs 7-03 and 7-04) unless otherwise shown on the drawings or directed by the contracting officer, or may be placed in the earth dike or miscellaneous fills. Excavated materials not used in such construction may be used in temporary construction if approved by the contracting officer or shall be disposed of otherwise in designated spoil areas as provided in Paragraph 4-03.

f. Measurement and payment. - (1) The applicable provisions of Paragraph 4-07d shall apply. Payment for all work in connection with excavation under Item 9, including the excavation of materials and any rehandling required, the hauling of materials to the point of disposal, and including shoring, sheeting, pumping and draining, will be made at the contract unit price for Item 9, "Common Excavation, Sewer Trench".

(2) Payment for backfilling trenches will be made under other items (see Sections VIII and IX).

(3) Payment for care and diversion of water and sewage and for the maintenance of operating sewers during construction will be made under Item 2 (see Section III).

(4) Payment for manhole excavation to 6 inches outside the manhole footing will be included in the contract lump sum price for Item 36 (see Paragraph 9-04e).

4-09. Removal of masonry structures and foundations. (Item 10). - a. Work included. - The contractor shall excavate and dispose of the materials in the existing concrete foundations, walls and other concrete or masonry structures south of Connecticut Boulevard as shown on the drawings, or as described in sub-paragraph b below. The concrete fragments shall be broken to sizes suitable for use as rock fill under Item 18 (see Paragraph 7-06).

b. Description. - (1) The concrete culvert at Station 135+00± is a box culvert 11.1 feet by 4.3 feet, with walls 1.3 feet thick.

(2) The stone masonry culvert at Station 135+00± is a box culvert 8.1 feet by 2.6 feet, with walls 1.3 feet thick.

(3) The concrete foundation for the Canoe Club at Station 151+00± has concrete walls 1.0 foot thick, and a total outside perimeter of 199 feet, more or less. The depth of foundation has not been determined.

c. Blasting. - (1) Blasting and the use of explosives shall be conducted as provided for in Paragraph 1-26.

(2) Blasting will be permitted only when proper precautions are taken for the protection of all persons, the work and the property. All damage done to the work or the property shall be repaired at the contractor's expense. All operations of the contractor in connection with the transportation, storage, and use of explosives shall be as approved by the contracting officer.

(3) Explosives of such quality and power shall be used in the locations which will, in the opinion of the contracting officer, neither crack nor damage the work outside the lines of excavation. Blasting shall be done only to the lines and grades shown on the drawings or approved by the contracting officer.

(4) Approval by the contracting officer of the method of blasting or the strength and amount of the explosive used, will not relieve the contractor of his responsibility in the blasting operations.

d. Disposal of materials. - As directed by the contracting officer all suitable materials excavated under Item 10 shall be placed in the rock fill toe on the river bank (see Paragraph 7-06). Excavated materials not used in such construction shall be disposed of in designated spoil areas as provided in Paragraph 4-03. Some stock-piling and rehandling may be necessary.

e. Payment. - The contract price for Item 10 shall include payment for all work in connection with the satisfactory removal of masonry structures and foundations and disposal of materials, in accordance with the drawings and specifications or as directed by the contracting officer. Payment will be made at the lump sum contract for Item 10, "Removal of Masonry Structures and Foundations".

SECTION V. STEEL SHEET PILING (Item 11).

5-01. Work included. - The contractor shall construct the steel sheet piling cut-off under the concrete flood wall and earth dike as shown on the drawings. The cut-off shall be constructed of piles of varying lengths, including specials, driven to grade, between the limits as shown on the drawings. Care shall be taken to avoid damage to existing sewers encountered in the work (see Paragraph 1-38).

5-02. Type and properties. - The piles shall be of the arch web type and shall have a minimum thickness of metal of 3/8 inch, except that a reasonable reduction for shaping the joints of the interlock will be permitted. The piles shall provide a section modulus of not less than 5.4 inches cubed per linear foot of cut-off, and shall weigh not less than 22 pounds per square foot of cut-off, exclusive of any welded or riveted connection or reinforcement. The interlocked joints shall develop a strength in direct tension of not less than 8,000 pounds per linear inch of interlock without rupture. The piles shall be continuously interlocked throughout their entire length and shall be provided with standard pulling holes. The type and dimensions of the piles the contractor proposes to furnish shall be submitted to the contracting officer for approval before any piles are delivered to the work.

5-03. Material. - The steel for the sheet piling shall be new and shall conform to Federal Specification QQ-S-751a for "Steel: Structural (Including Steel for Cold Flanging) and Steel: Rivet (for) Ships other than Naval Vessels," Structural Grade, except for the following requirements:

a. Tensile strength shall be not less than 70,000 pounds per square inch, except that fabricated sections such as corner piles, toe piles and other special sections shall be of steel having a tensile strength of not less than 60,000 pounds per square inch.

b. Elongated in 8 inches, minimum $\frac{1,400,000}{\text{tensile strength}}$

c. Bend test specimens shall withstand bending 180 degrees around a pin with a diameter twice the thickness of the specimen without fracture on the outside of the bend.

5-04. Driving. - The piles shall be driven to form a continuous interlocking diaphragm down to the elevation established for the bottom of the cut-off, as shown on the drawings. A protecting cap shall be used in driving. The hammers shall be of a suitable size and type, either steam or air operated. The use of a water jet may be permitted at the discretion of the contracting officer. Piles shall be driven without injury to them, as true to line and grade as possible, and shall be cut off, where necessary, to the top elevation of the sheet piling cut-off as shown on the drawings. Proper precautions shall be taken to

prevent rupture at the interlocks. Piles ruptured at the interlock or otherwise injured shall be removed and replaced by new piles at the contractor's expense. Special sections, including toes, corners and wedges, shall be installed as shown on the drawings, or if in the opinion of the contracting officer, such sections are necessary to insure proper construction of the sheet piling cut-off.

5-05. Measurement and payment. - a. - The quantity of steel sheet piling to be paid for will be the number of square feet of sheet piling actually in place as specified below the top elevation of the sheet piling cut-off. Payment will be made at the unit contract price for Item 11, "Steel Sheet Piling", and shall include the costs of all labor, materials, equipment and incidentals required to construct the sheet piling cut-off as specified.

b. - Partial payment at the rate of 50 per cent of the unit contract price will be made for steel sheet piling delivered at the site but not installed in the work, provided it has been accepted for use and is stored or protected in a manner satisfactory to the contracting officer. The remainder of the contract price, less retained percentage, if any, will be paid when the steel sheet piling has been incorporated in the work as required by the specifications. Proper deductions will be made in subsequent estimates for any partial payments made for steel sheet piling not used in the work.

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SECTION VI. EARTH DIKE (Items 12 and 13)

6-01. Definitions. - The term "embankment" as used in these specifications includes earth fill of all types for the earth dike, ramps, cut-off trench, and all other specified or directed earth fills within the limits of the dike necessary to complete the embankment. As shown on the drawings, the various types of earth fill are "selected impervious" under Item 12, for the cut-off trench and the blanket on the riverside of the embankment; the "pervious" under Item 13, forming the landside shoulder of the embankment, and the "random" under Item 13 forming the section between the impervious and pervious sections, or as otherwise required at ramps as shown on the drawings.

6-02. Work included. - The contractor shall grade and consolidate materials required for the embankment, to the elevation, lines, grades and cross sections shown on the drawings, with such increased height and width as may be deemed necessary by the contracting officer to allow for later shrinkage or settlement. The contractor shall use suitable materials as approved by the contracting officer, excavated from the required excavations and approved borrow areas shown on the drawings.

6-03. Materials. - a. General. - All materials from required excavations will be used in the embankment, if, as excavation proceeds, they are found suitable by the contracting officer. Brush, roots, sod, any type of organic materials, and other perishable or unsuitable material as determined by the contracting officer shall not be placed in the embankment. Materials shall not be wasted except by specific instructions from the contracting officer.

b. Borrow. - (1) Other suitable materials shall be borrowed from locations shown on the drawings in accordance with Paragraphs 1-24 and 4-06. The origin of any material from either structure or borrow excavations does not definitely determine where it will be used in the embankment. Materials from two or more excavation or borrow areas may be required to be used at the same time and in the same part of the embankment, mixing being done in the process of placing by systematic dumping, spreading and bulldozing. Materials from one area may be required to be used in different parts of the embankment.

(2) Suitable pervious materials shall be obtained by hydraulic methods from the river bed adjacent to the work. Unless otherwise specified such materials shall be stockpiled and allowed to dry until the moisture content is low enough to permit the placement of the materials in the embankment in accordance with the requirements of Paragraph 6-06 (see Paragraph 4-06b).

c. Test requirements. - The various types of earth fill defined in Paragraph 6-01 shall conform to the test requirements and approved classification established by the Soils Laboratory, U. S. Engineer

Office, Providence, Rhode Island. The contractor shall furnish the necessary labor and facilities for taking test samples which will be removed from the embankment by representatives of the contracting officer and subjected to field tests or boxed for shipment to the Soils Laboratory. Test samples will be taken at such intervals as will give, in the opinion of the contracting officer, a comprehensive knowledge of the material and its placement and compaction in each section of the embankment.

6-04. Plowing. - Immediately prior to the placing of materials in the embankment, and after stripping has been completed (see Paragraph 4-04), the entire foundation of the embankment shall be thoroughly plowed and broken to a depth of 4 inches. The furrows shall run approximately parallel to the axis of the embankment. All roots, stones, and debris or other objectionable material shall be removed and disposed of, as directed by the contracting officer. The condition of the surface material of the foundation area at the time of plowing shall be slightly drier than the required moisture content for rolled embankment. The requirements for plowing do not apply to the side slopes of the cut-off trench and stump holes. Plowing shall be completed not less than 200 feet in advance of the embankment. After plowing, the entire surface of the foundation area shall be rolled in accordance with Paragraph 6-06d.

6-05. Filling of excavations in embankment area. - a. General. - The cut-off trench, test pits, stump holes, and other excavated areas within the limits of the embankment and as otherwise shown on the drawings shall be filled with pervious, random, or impervious materials in the dry as directed by the contracting officer. The fill shall be placed in layers, moistened, and rolled in accordance with Paragraph 6-06 whenever, in the opinion of the contracting officer, it is possible to do so. Material which cannot be compacted by roller equipment because of insufficient clearances, shall be spread in 4-inch layers and compacted with hand or power tampers which shall give the degree of compaction required for the embankment. As the fill is brought up, the side slopes of the cut or hole shall be scarified by equipment or by hand if it is required, in the opinion of the contracting officer, in order to provide a bond between the fill and the original ground material (see Paragraph 6-06d(2)).

b. Stump holes. - The sides of stump holes shall be broken down with bulldozers or a disc harrow so as to flatten out the slopes, and the hole then filled with approved material and properly rolled or tamped in place.

c. Cut-off trench. - The fill for the cut-off trench shall be placed in the dry and rolled in accordance with Paragraph 6-06. The water shall be drained to a sump and removed by pumps. The fill shall be made by working the materials toward the sump and sloping the surface of the fill longitudinally toward the sump. Well points may be used for drying up the foundation when approved by the contracting officer.

6-06. Rolled fill. - a. General. - (1) The selected impervious, random and pervious sections of the embankment shall be constructed with a crown running with the center line of the dike and with slopes approximately on a 2 per cent grade toward the edges of the embankment, except as otherwise provided for in subparagraph (2) below. This slope shall be maintained until the completion of the embankment, thus bringing up together the impervious, random and pervious sections, unless otherwise directed by the contracting officer. As soon as practicable, the embankment shall be brought to a nearly uniform grade for the entire length.

(2) For the alternate method of construction under Item 7A, which requires dredging pervious and random materials from the river directly to their final position in the embankment sections, the provisions of subparagraph (1) above shall not apply. The pervious and random sections shall be constructed by hydraulic methods to such height and extent as may be directed by the contracting officer (see Paragraph 4-06b(4)), before the construction of the selected impervious section is begun. The selected impervious section shall be constructed in accordance with the provisions for rolled fill as directed by the contracting officer, and carefully bonded to the previously constructed portion of the embankment. As soon as practicable, the embankment shall be brought to a nearly uniform grade for the entire length.

b. Furnishing and placing. - (1) The contractor may use power shovels, drag lines, or any type of excavating machinery which is capable of excavating the materials in dry condition. The contracting officer will specify the location in the borrow areas and the depth to which excavation shall be made. The contractor may use any approved method of transporting materials in natural dry condition. The dumping of the successive loads shall be at locations as directed by the contracting officer. Sufficient excavating and hauling equipment shall be available so that not less than two sources of material can be worked at the same time. When two or more different materials are being moved into a section of the embankment they shall be spotted and dumped systematically so that in any area of the section there are approximately the required proportions of the materials. After dumping, the materials for the impervious section shall be bulldozed or otherwise spread in approximately 8-inch layers and rolled (see Paragraph 6-06d.). The random and pervious materials shall be spread in layers approximately 12 inches in thickness as determined by the contracting officer and rolled (see Paragraph 6-06d.). Should the material for the various sections of the embankment be too high in water content when dumped, it shall be bulldozed or otherwise spread and harrowed or stirred for a sufficient time to allow the surplus water to dry out before being rolled. If, in the opinion of the contracting officer, the rolled surface of any layer of the materials is too smooth to bond properly with the succeeding layer or, if the materials have dried out sufficiently to cause cracks in the surface, it shall be roughened or loosened by a disc harrow, or other approved means, and dampened, if required, before the succeeding layer is placed thereon. All roots, trash, and debris shall be promptly removed from the embankment and disposed of to the satisfaction of the

contracting officer. Stones greater than 6 inches in diameter shall be removed from the impervious and random sections and when approved by the contracting officer, shall be placed in the pervious section of the embankment. The entire surface of the embankment shall be maintained in such condition that construction equipment can travel thereon. Routing of construction equipment on the embankment shall be subject to direction by the contracting officer.

(2) Any embankment material lost or loosened, after being placed in the embankment and before the completion of the contract and acceptance of the completed work, because of any operation of the contractor or for other causes that in the opinion of the contracting officer were avoidable or under the control of the contractor, shall be replaced by the contractor to the satisfaction of the contracting officer and without cost to the Government. (See Paragraph 6-14c.).

(3) The contractor shall cease work on the embankment at any time when, in the opinion of the contracting officer, satisfactory work cannot be done on account of rain, high water, cold weather, or other unsatisfactory conditions.

c. Moisture control. - To obtain the desired compaction for the varying kinds of materials used, the moisture content of the material being placed shall be the optimum required for satisfactory compaction as determined by the contracting officer. If required, the compacted surface shall be sprinkled as directed immediately before placing each new layer. The moisture content shall be sufficient to dampen the fill materials as required, but the amount of sprinkling shall be controlled so that no free water will appear on the surface during or subsequent to the rolling. An adequate supply of water shall be available. Jets shall not be directed at the embankment material with such force that the finer materials are washed out.

d. Compaction. - (1) Tamper type roller. - Rolling for the impervious section of the embankment shall be done by a tamper type twin roller such as a "sheeps-foot" roller, water or sand ballasted, having tamping feet uniformly staggered over its cylindrical surface, and equipped with cleaners; or other satisfactory type of tamper roller as approved by the contracting officer. Each tamping foot shall project approximately 7 inches from the roller's cylindrical surface and shall have a face area of not less than 5 and not more than 7 square inches. The spacing shall be such as to provide a minimum of two tamping feet for each square foot of cylindrical surface. Addition or reduction in the number of tamping feet shall be made when directed by the contracting officer. The total weight of the roller in pounds divided by the total area of the maximum number of tamping feet in one row parallel to the axis of the roller shall be not less than 115 pounds per square inch tamping foot area with the drum empty, and not less than 200 pounds per square inch tamping foot area with the drum ballasted. The design and operation of the tamping roller shall be subject to the approval of the contracting officer.

(2) Rolling impervious section. - When the moisture content and condition of the spread impervious layers of the embankment are satisfactory to the contracting officer, the contractor shall roll the impervious section of the embankment with tamper type twin rollers. Each set of twin rollers shall be pulled by a crawler type tractor of suitable power, weighing not less than 20,000 pounds, manufacturer's standard weight, at a speed of approximately 2-1/2 miles per hour. Each square foot of each layer of the embankment material shall be compacted by not less than six passes of the rollers, and ordinarily not more than nine passes as required by the contracting officer. Successive trips of rollers shall overlap by at least 2 feet. Failure to comply with this requirement for careful rolling will be a cause for additional trips at the contractor's expense. Where new material abuts old material, either in place or in embankment, the old material shall be cut or broken by machine or hand methods approved by the contracting officer, until it shows the characteristic colors of undried materials, and the rollers shall work on both materials, bonding them together. Portions of the earth fill which the roller cannot reach for any reason shall be thoroughly compacted by tamping with hand or power tampers in 4-inch layers. The compaction for such portions of the earth fill shall be equivalent to that obtained by sprinkling and rolling as specified for the other portions of the earth fill.

(3) Rolling random and pervious sections. - Rolling of the random and pervious sections of the embankment shall be the same as specified above except that a minimum of 3 passes of the rollers will be required. Rolling will not be required for that portion of the embankment placed by hydraulic methods (see Paragraph 4-06b(4)). If, in the opinion of the contracting officer, better compaction can be obtained by the use of a plain cylindrical roller, or a Parson's disc tamping roller or approved equal, the use of such a roller may be required. This roller shall weigh not less than 1100 pounds per linear foot. When conditions of the work so require, at the direction of the contracting officer, rolling may be done by a crawler type tractor weighing not less than 20,000 pounds; in such cases a maximum of four passes of the tractor treads on each square foot of embankment area will be required.

(4) Tests for compaction. - Samples of all embankment materials for testing, both before and after placing and compaction, will be taken at frequent intervals under the supervision of the contracting officer. Corrections, adjustments, modifications of methods, selection of material and moisture content will be made from these tests to secure the maximum density of the materials in the embankment (see Paragraph 6-03c.).

e. Impervious fill. - Impervious fill shall be selected and secured from required excavations and borrow areas as directed by the contracting officer, and shall be placed in the select impervious section of the embankment throughout the entire length.

f. Random fill. - Random fill shall be selected and secured

from required excavations as directed by the contracting officer, and shall be placed in the random section of the embankment. In general this material shall be placed so the coarser portions are toward the landside, and the finer portions near the select impervious section, so that a gradational transition is effected from the impervious to the pervious section.

g. Pervious fill. - The pervious fill shall be selected and secured from required excavations and borrow areas as directed by the contracting officer, and shall be placed in the pervious section of the embankment. The pervious section of the embankment shall be graded from the finer materials near the random section to the coarser materials near the landside face of the embankment. Special care shall be taken to place the coarser material and cobbles adjacent to the landside face of the embankment.

6-07. Removal of objectionable material. - The contractor shall, when directed by the contracting officer, excavate, remove and dispose of any material from the embankment sections which the contracting officer considers objectionable in such locations, and refill the area as directed in accordance with Paragraph 6-05.

6-08. Slides. - In case of slides in any part of the embankment during the construction or after completion, but prior to the final acceptance of the work, the contractor shall cut out and remove the area specified by the contracting officer and then rebuild the excavated area in accordance with these specifications. In case it is determined that the slide was caused through the fault of the contractor, the foregoing shall be performed at no cost to the Government.

6-09. Frozen materials. - No earth shall be placed upon a frozen surface, nor shall frozen earth, snow or ice be placed in the embankment. In cases of emergency the contracting officer may require frozen material to be stockpiled for later use in the embankment.

6-10. Shrinkage or settlement. - No measurement will be made of additional material placed on account of settlement of the foundation or shrinkage during construction. The cost of placing and compacting such additional material shall be included in the contract prices for the various items of the fill. Measurement and payment of all required fill material excavated and transported to point of placement will be in accordance with Section IV.

6-11. Temporary drains and ditches. - The contractor shall maintain the site of the work and the grounds immediately adjacent thereto, free from collected surface water if, in the opinion of the contracting officer, such collected water affects the safety or condition of the work. Such temporary drains and ditches shall be constructed as may be deemed necessary and directed by the contracting officer.

6-12. Topsoil and sodding. - a. Placing topsoil. - Unless otherwise

authorized by the contracting officer, a suitable topsoil shall be placed on the slopes of the earth dike as shown on the drawings. Payment for placing topsoil will be made under Item 44 (see Paragraph 13-01).

b. The areas upon which topsoil has been placed shall be sodded and seeded as specified in Paragraph 13-01. Payment for sodding and seeding will be made under Item 45.

6-13. Gravel for top of dike. - Unless otherwise directed by the contracting officer, the top of the dike shall be surfaced with a layer of gravel as shown on the drawings. Payment for placing the gravel surfacing will be made under Item 46 (see Paragraph 13-02).

6-14. Measurement and payment. - a. The quantities to be paid for under Items 12 and 13 will be the number of cubic yards placed as directed, measured in place after compacting. Payment shall include the work of preparing the base, spreading in layers, wetting, rolling or tamping, trimming to line, and shall include all labor and materials incidental to completing the embankment, not specifically included under other items. Payment will be made at the contract unit prices for Items 12 and 13 as applicable (see Paragraph 1-05).

b. To determine the quantities to be paid for, a survey will be conducted prior to the beginning of the placing of the fill. The true surface condition will be shown by cross sections and profile and the measurement of the quantities will be based upon this survey. The quantities will be the volume between the original surface at the beginning of the work, and the slope lines and grades as indicated on the drawings, or as directed by the contracting officer. The quantity to be paid for under Item 13 will depend on the amount of material placed hydraulically under Item 7A.

c. Additional payment will be made to replace embankment washed out by flooding or scouring, or that required to be removed on account of slides, or the removal and disposal of all objectionable materials placed at the direction of the contracting officer; provided such replacement of embankment was not caused by negligence or carelessness of the contractor. Quantities for additional payment will be measured as directed by the contracting officer and payment will be made at the applicable contract unit prices.

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SECTION VII. MISCELLANEOUS FILL AND BACKFILL (Items 14 to 18 incl.)

7-01. Definitions. - The term "gravel bedding" includes the gravel blanket immediately underlying the riprap as shown on the drawings and the gravel required for filters. "Compacted backfill" is generally structure backfill behind the concrete flood wall and other structures or backfill over culverts and sewers under the dike as shown on the drawings. "Semi-compacted backfill" refers to backfill in pipe or sewer trenches not completely compacted. "Miscellaneous fill" refers to fill required to grade low spots in the terrain behind the dike and flood wall. "Dumped rock fill" refers to the rock fill required at the toe of the river bank.

7-02. Gravel bedding. (Item 14). - a. Work included. - The contractor shall place a layer of gravel bedding upon which riprap will be placed at the locations shown on the drawings. The contractor shall also place a layer of gravel of the specified quality required for filters at the locations shown on the drawings or as directed by the contracting officer.

b. Materials. - Gravel bedding shall consist of suitable coarse clean gravel satisfactorily graded within the specified limits. Unless otherwise directed, not more than ten per cent by weight shall pass a sieve having 10 meshes to the inch, and all shall pass a 2-inch square mesh screen.

c. Placing. - The material shall be placed as shown on the drawings or as directed, and with such hand placing as may be necessary to trim to the required slopes. The contractor will not be required to tamp or roll the material, but will be required to consolidate it with water to the extent directed so that no settlement or voids will later result.

d. Measurement and payment. - The quantity to be paid for under Item 14 will be the number of cubic yards furnished and placed to the limits, lines and grades shown on the drawings, or ordered. Payment will be made at the unit contract price for Item 14, "Gravel Bedding".

7-03. Compacted backfill (Item 15). - a. Work included. - The contractor shall place, grade, and consolidate materials required for backfill of the flood wall and of other concrete or manhole structures, for backfill of culvert or sewer trenches under the dike, and in consolidated embankments elsewhere as directed, except those required under other items.

b. Borrow. - Materials shall be borrowed from stockpiles of excavated materials (see Paragraphs 4-03 and 4-08e), or may be obtained directly from required excavations. Backfill material shall be free from stumps, roots, sod, rubbish, or other unsuitable materials or substances.

c. Placing. - The backfills shall consist of materials suitable for the purpose in the opinion of the contracting officer, and shall be placed in successive layers of not more than 12 inches in depth for the full width of the cross section. Each layer shall be compacted thoroughly with a crawler type tractor weighing not less than 20,000 pounds, or as provided in Paragraph 6-06 d (3). A minimum of four passes of the tractor treads on each square foot of backfill area will be required for satisfactory compaction. Portions of the backfill area which the compacting equipment cannot reach for any reason shall be thoroughly compacted by tamping with hand or power tampers in 2-inch layers. The compaction for such portions of the backfill shall be equivalent to that obtained by compacting with tractor equipment.

(2) Backfill on the landside of the concrete flood wall shall be semi-compacted backfill (see Paragraph 7-04), except where it occurs within the limits of the dike. Backfill on the riverside of the concrete flood wall shall be compacted backfill throughout.

d. Measurement and payment. - Measurement will be made by the cubic yard for the amount of compacted backfill placed in the completed work to the lines and grades shown on the drawings or as directed by the contracting officer. Quantities will be measured in place after any settlement. Payment for all work in connection with furnishing and placing compacted backfill will be made at the contract unit price for Item 15, "Compacted Backfill".

7-04. Semi-compacted backfill (Item 16). - a. Work included. - The contractor shall place, grade and consolidate materials required for semi-compacted backfill over pipe drains and culverts, and at other locations as directed by the contracting officer. The material shall be placed in 12-inch horizontal layers with only such hand placing as may be necessary to trim to the required slopes. The contractor will not be required to roll the material, but will be required to consolidate it with water to the extent directed so that no settlement or voids will later result. Hand tamping shall be done where required by the contracting officer.

b. Materials. - Materials shall be obtained from stockpiles of excavated materials (see Paragraphs 4-03 and 4-06e), or may be obtained directly from required excavations. Backfill material shall be free from stumps, roots, sod, rubbish or other unsuitable materials or substances.

c. Measurement and payment. - Measurement will be made by the cubic yard for the amount of semi-compacted backfill placed in the completed work to the lines and grades shown on the drawings or as directed by the contracting officer. Quantities will be measured in place after any settlement. Payment for all work in connection with placing semi-compacted backfill will be made by the cubic yard under Item 16, "Semi-compacted Backfill".

7-05. Miscellaneous fill (Item 17). - a. Work included. - The contractor shall place and grade materials required to fill low spots in the terrain behind the dike and flood wall as shown on the drawings or as directed by the contracting officer. Compaction by rolling will not be required.

b. Materials. - The provisions of Paragraph 7-04b shall apply.

c. Measurement and payment. - Measurement will be made by the cubic yard for the amount of miscellaneous fill placed to the lines and grades shown on the drawings or as directed by the contracting officer. Quantities will be measured in place after any settlement. Payment for all work in connection with placing miscellaneous fill will be made at the contract unit price for Item 17, "Miscellaneous Fill".

7-06. Dumped rock fill (Item 18). - a. Work included. - (1) The contractor shall furnish all equipment and labor required to construct the dumped rock fill at the toe of the river bank. The rock fill shall be to the limits, lines and grades shown on the drawings or as directed by the contracting officer, at or below the low water level of the river.

(2) The contractor shall do all the preliminary grading and other incidental work, not included in any other item, required to prepare the site for the rock fill.

b. Material. - (1) Rock fill shall be composed of durable stone or concrete fragments of acceptable sizes. Suitable rock, boulders and large cobbles from borrow areas or quarries, and concrete fragments from the required excavations (see Paragraph 4-09d), shall be used. The rock fill shall be constructed of the thickness and to the extent shown on the drawings or directed. The average surface of the rock fill shall satisfactorily approximate the lines and grades shown on the drawings. The rock shall be carefully dumped in place with the larger rocks at the outer faces and the smaller rocks and spalls adjacent to the river bank. The rock fill shall consist of fragments of stone or concrete of which none shall be smaller than one cubic foot and of which those exceeding one-half cubic yard shall constitute at least 50 per cent of the volume, except as otherwise authorized by the contracting officer.

(2) Generally the maximum allowable size of single pieces of rock or concrete shall be one cubic yard.

c. Measurement and payment. - (1) The quantity to be paid for under Item 18 will be the number of cubic yards of rock fill furnished and placed to the specified lines or grades in the completed work. (See Paragraph 6-14b). Payment will be made at the contract unit price for Item 18, "Dumped Rock Fill". The unit contract price shall include payment for all equipment, labor and incidentals required to construct the rock fill.

(2) The quantity stated in Paragraph 1-05 may be increased or decreased as directed by the contracting officer, or deleted entirely in the event that dumped rock fill is not used.

SECTION VIII. RIPRAP AND DRAINS (Items 19 to 21 incl.)

8-01. General. - "Riprap - Hand Placed", Item 19, will be required for paving of the riverside slope of the dike and at other locations, as shown on the drawings or as directed by the contracting officer. "Grouted Stone Gutters", Item 20, will be required along ramps and roadways, or elsewhere as shown on the drawings or as directed by the contracting officer. "10-inch Corrugated Pipe", Item 21, will be required for road culverts as shown on the drawings.

8-02. Riprap - Hand placed (Item 19). - a. Work included. - Riprap shall be placed to the lines and grades shown on the drawings, on the riverside slope of the dike, and elsewhere as required by the contracting officer.

b. Material and placing. - Riprap shall be of durable rock of acceptable sizes with a specific gravity of not less than 2.65. The riprap shall be laid to the lines and grades shown on the drawings or as directed. A tolerance of 3 inches above or below the slope line shown on the drawings will be allowed for the finished slope surface of the hand-placed riprap. Rock for riprap shall be angular and of uniform shape so as to furnish an even, reasonably smooth surface. Not more than 5 per cent by weight of the rock shall be smaller than one-half cubic foot in colume and at least 75 per cent of the rock used shall be from 1/2 to 1 cubic foot in volume with one dimension approximately equal to the depth of the riprap course. The rock shall be closely laid on a base of gravel bedding (see Paragraph 7-02), with the proper dimension normal to the slope, and with joints broken where possible. The joints on the surface of the riprap shall be filled with tightly driven spalls. Large rock shall be well bedded at the edges of the riprap to prevent undermining.

c. Measurement and payment. - The quantity to be paid for under Item 19 will be the number of cubic yards of riprap satisfactorily placed in the completed work to the specified or ordered lines and grades. Payment will be made at the contract unit price for Item 19, "Riprap - Hand Placed", and shall include all costs for furnishing, hauling and placing the riprap.

8-03. Grouted stone gutters (Item 20). - a. Work included. - (1) Hand-placed riprap shall be placed to the lines and grades shown on the drawings, for paving the gutters along the ramps and roadways at the locations shown on the drawings or elsewhere as directed by the contracting officer.

(2) The contractor shall furnish and place grout for surface grouting all hand-placed riprap in the gutters.

b. Material and placing. - (1) Riprap shall be of durable rock of acceptable sizes. Suitable rock from borrow areas and quarries

shall be used. The riprap shall be laid to the lines and grades shown on the drawings or as directed. The rock shall be hand-placed, to a tolerance of 1 inch above or below the finished surface shown on the drawings. No individual rock shall be less than 10 pounds or more than 30 pounds in weight, and at least 75 per cent of the rock used shall be at least 20 pounds in weight. The rock shall be closely laid on a base of gravel bedding (see Paragraph 7-02), with the long dimension normal to the slope, and with joints broken where possible.

(2) Grouting shall be done on clean riprap surfaces with a grout mixture of 1 part Portland cement and 2-1/2 parts sand by volume combined with water to a suitable consistency. Cement and sand used in the grout shall be obtained from approved commercial sources and subject to the approval of the contracting officer. The grout shall be worked into the joints of the riprap surface with brooms or other means so as to fill the voids completely.

c. Measurement and payment. - The quantity to be paid for under Item 20 will be the number of square yards of riprap placed to the specified lines and grades in the completed work. Payment shall include all costs for furnishing, hauling, placing and grouting the riprap. Payment will be made at the contract unit prices for Items 20(a) and 20(b), "Grouted Stone Gutters," applicable to the respective thicknesses placed (see Paragraph 1-05).

8-04. 10-inch corrugated pipe (Item 21). - a. Work included. - The contractor shall furnish and lay 10-inch diameter corrugated metal pipe, required for road culverts as shown on the drawings.

b. Materials. - All pipe shall meet the requirements of Federal Specification QQ-C-806, as amended March 1936. No pipe sections will be accepted unless the metal is identified by a stamp showing name of manufacturer, name of plant, kind of base metal and gage number.

c. Excavation. - Excavation shall be done as shown on the drawings and as provided for in Paragraph 4-05. Pipe trenches shall have a depth of not less than 2 feet and a width at least 12 inches greater than the outside diameter of the pipe. The bottom of the trench throughout its length shall be carefully formed to fit the circular shape of the pipe, so that the pipe shall be firmly supported on the bottom and for at least 3 inches up each side. All rock or boulders shall be removed to a depth of 6 inches below the bottom grade of the trench and the voids backfilled with well compacted suitable material.

d. Laying pipe. - All pipe shall be placed in the trench immediately after the excavation is completed. Proper care shall be used in handling the pipe to avoid injury. The pipe shall be carefully bedded, and properly connected and jointed. The pipes shall be laid true to the lines and grades shown on the drawings or as staked in the field. The interior of the pipe shall be carefully cleaned after laying to remove dirt and other obstructions.

e. Backfilling. - Backfill material shall be evenly spread and compacted under and around the pipe. Backfill over the pipe shall be done in accordance with the provisions of Paragraph 7-04, unless otherwise shown on the drawings or directed by the contracting officer.

f. Measurement and payment. - (1) Measurement for payment will be based on the linear feet of pipe of the size installed. Payment for pipe will be made at the contract unit price for Item 21, "10-inch Corrugated Pipe", and shall include all costs of furnishing and installing the pipe except the cost of excavation, backfilling, and any concrete required.

(2) Payment for excavation will be allowed under Item 4 (see Paragraph 4-07d). Payment for backfilling will be allowed under Item 16 (see Paragraph 7-04c). Payment for concrete will be allowed under Item 39 (see Paragraph 11-03b).

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c. Special test requirements. - Cement will be tested by the Government at the Central Concrete Laboratory, West Point, N. Y. No cement shall be used until notice has been given by the contracting officer that the test results are satisfactory. Cement which has been stored, other than in bins at the mills, for more than 4 months after being tested shall be retested before use. Ordinarily, no cement shall be used until after it has satisfactorily passed both the 7 and 28-day tests, but in cases of emergency the contracting officer may waive the 28-day tests and permit the use of cement which has satisfactorily passed the soundness and 7-day tests; provided it is the product of a quarry and mill having established a reputation of not less than 3 years' standing, for the production of high-grade cement. If the tests prove any cement unsatisfactory which has been delivered at the site of the work, such cement shall be promptly removed from the work and its vicinity.

d. Identification. - Cement shipped in bags shall be positively identified by marking or tagging the bags with the identifying number or symbol of the Federal Specifications under which it was manufactured. Bulk shipments of cement shall be likewise identified by a suitable device affixed to each car or other type of bulk carrier. Marking or tagging shall be done at the mill.

e. Quality and packages. - All cement shall be dry-finely ground and free from lumps or caking. Unless otherwise permitted, the cement shall be delivered in canvas bags or other strong, well-made packages, each plainly marked with the manufacturer's brand. The weights of such bags shall be uniform. Packages received in broken or damaged condition will be rejected or accepted only as fractional packages. Cement shall be stored in a satisfactory manner so as to be unaffected by moisture, keeping each carload separate until the results of the 28-day tests are known. Suitable accurate scales shall be provided by the contractor for weighing the cement.

f. Records of cement used. - The contractor shall furnish to the contracting officer, at the end of each day's work, a statement showing in such detail as he may reasonably require the quantity of cement used during the day at each part of the work.

10-06. Fine aggregate. - a. Composition. - Fine aggregate shall be natural sand.

b. Quality. - Fine aggregate shall consist of hard, strong, durable and uncoated particles.

c. Grading. - (1) Except as provided in (2) below fine aggregate shall conform to the following requirements:

Total passing -	Per cent by weight
No. 4 sieve	95 - 100

SECTION IX. CULVERTS, SEWERS, VALVES AND MANHOLES (Items 22 to 36 incl.)

9-01. General. - a. Extensions and connections to existing sewers or drainage culverts shall be made where necessary to carry the discharge of sewers and drains beyond the new flood protection work. All extensions and connections shall be made in accordance with the details shown on the drawings. New culverts and sewers shall be installed and old sewers removed at the locations shown on the drawings or as directed by the contracting officer. Provisions for the care and diversion of water and sewage, and for the maintenance of operating sewers during construction, shall be made (see Section II). Concrete seep-rings shall be constructed as shown on the drawings.

b. Gates and valves or other specials and fittings required shall be installed as shown on the drawings or as directed by the contracting officer.

c. Brick manholes shall be constructed as shown on the drawings or as directed by the contracting officer.

9-02. Culverts, sewers and valves (Items 22 to 34 incl.) - a. Materials. - (1) Cast iron culverts shall be used in sewer or drainage connections which extend under or through the earth dike, and shall have flap valves at the outlet ends as shown on the drawings. Tile and concrete pipe shall be used for collecting drains and tile pipe shall be used for connecting the landside toe drains of the earth dike to collecting drains.

(2) Concrete pipe shall conform to Federal Specification SS-P-371 for "Pipe; Concrete, Reinforced."

(3) Cast iron pipe shall be bell-and-spigot unless otherwise indicated, conforming to the requirements of current American Water Works Association specifications for standard weight pipe, Class C.

(4) Tile pipe shall be bell-and-spigot, vitrified, salt-glazed, stoneware pipe conforming to the requirements of Federal Specification SS-P-361, or subsequent amendments or revisions thereof. Each pipe shall be carefully inspected immediately before laying and no cracked, broken or otherwise imperfect pipe shall be used, except for minor defects which in the opinion of the contracting officer do not impair the fitness of the pipe for the purpose intended.

(5) Gate valves shall be double disk gate valves as shown on the drawings, similar and equal to the Crane type, No. 791.

(6) Flap valves shall be of cast iron body, suitable

for use under 10 to 20-foot head as shown on the drawings, similar and equal to the Chapman type, No. 25.

(7) Sluice gates to be installed in valve chambers as shown on the drawings, shall conform to the details shown on the drawings unless otherwise directed by the contracting officer.

(8) Other materials shall be standard products suitable for the use intended and subject to the approval of the contracting officer (see Section XII).

b. Installation of pipe. - (1) Excavation. - Excavation shall be done as shown on the drawings and as provided for in Paragraph 4-06. Pipe trenches shall have a depth of not less than 2 feet with vertical sides and a width 16 inches greater than the inside diameter of the pipe, unless otherwise directed. The bottom of the trench throughout its length shall be carefully formed to fit the circular shape of the pipe except as otherwise shown on the drawings, so that the pipe shall be firmly supported on the bottom and for at least 3 inches up each side. All rock or boulders shall be removed to a depth of 6 inches below the bottom grade of the trench and the voids back-filled with well compacted suitable material. Suitable excavations shall be made to fit all junctions or other specials wherever needed. Joints in pipe shall be located as shown on the drawings, with relation to adjacent structures, sheet piling and concrete seep rings.

(2) Laying pipe. - (a) Reinforced concrete pipe. - All pipe shall be placed in the trench immediately after the excavation is completed. Proper care shall be used in handling the pipe to avoid injury or breakage. The pipe shall be carefully bedded, and properly connected and jointed. Bell holes shall be excavated to insure that each pipe shall rest firmly upon its bed for the entire pipe length. The pipe shall be laid true to the lines and grades shown on the drawings or as staked in the field. Joints shall be made with cement mortar composed of one part Portland cement and 2-1/2 parts sand. All mortar used shall be thoroughly mixed either by hand or in a mechanical batch mixer. Mortar shall be prepared in such quantities that it can be used entirely before it has attained its initial set. The minimum amount of water sufficient to make a workable mortar shall be used. Cement and sand used in mortar shall conform to the requirements of Paragraphs 10-05 and 10-06. The spigots shall be centered in the bells, and there shall be no shoulders or unevenness of any kind along the bottom half of the pipes. Special care shall be taken that the joint space be of equal width around the pipe, making use of jute or oakum gaskets soaked in cement ground and carefully caulked into the joints. The mortar shall be thoroughly troweled into the joint, and a sufficient overfill shall be made to hold the mortar in the joint firmly in place. The interior of the pipe shall be carefully cleaned after laying to

remove dirt, mortar and other obstructions.

(b) Cast iron pipe. - Applicable provisions of subparagraph (a) above shall apply, except for joints. Bell-and-spigot joints shall be fully fitted together and shall be made fast by first adjusting the spigot end with wedges to obtain a uniform joint space; then thoroughly packed with oakum or jute and caulked with lead. The pipe shall be bedded in concrete as shown on the drawings. Before backfilling, the pipe shall be tested for leakage by a suitable water-pressure test as directed by the contracting officer.

(c) Tile pipe.- 1. For tile pipe laid with cemented joints, the applicable provisions of subparagraph (a) above shall apply.

2. For tile pipe laid with open joints, the applicable provisions of subparagraph (a) above shall apply, except for joints. Pipe with open joints shall be laid true to line and grade, with bells upgrade and with spigot ends fully entered in the bells. A strip of burlap at least 6 inches in width and 36 inches in length shall be carefully and securely wrapped around the pipe joints.

(3) Backfilling. - (a) Reinforced concrete and cast iron pipe. - Backfill material shall be evenly spread and compacted under and around the pipe. Backfill over the pipe shall be done in accordance with the provisions of Paragraph 7-03, unless otherwise shown on the drawings or directed by the contracting officer. Hand tamping shall be done as directed.

(b) Tile pipe. - 1. For pipe laid with cemented joints, the backfill material shall be evenly spread and compacted under and around the pipe. Backfill over the pipe shall be done in accordance with the provisions of Paragraph 7-03, unless otherwise shown on the drawings or directed by the contracting officer. Hand tamping shall be done as directed.

2. For pipe laid with open joints, the backfill material as shown on the drawings shall be evenly spread and compacted around and over the pipe to the limits shown on the drawings or as directed by the contracting officer (see Paragraphs 7-02 and 7-04).

(4) Gates and valves. - Existing drainage gates or valves at the present points of entry or outlet of sewers shall be reused so far as possible. Necessary repairs shall be made prior to resetting. New gates or valves of the size and type required (see Paragraphs 9-02 a(5), (6) and (7)), shall be furnished and installed as shown on the drawings.

c. Measurement and payment. - (1) Measurement for payment will be based on the linear feet of pipe of the respective kinds and

sizes installed. Payment for pipe will be made at the contract unit prices for Items 22 to 34, respectively (see Paragraph 1-05), and shall include all costs of furnishing and installing pipe, including specials and making connections to existing sewers, except the cost of excavation, backfilling, gates and valves, and any concrete required.

(2) Payment for excavation will be made under Item 9 (see Paragraph 4-08f). Payment for backfilling will be made under Item 14, 15, and 16 (see Paragraphs 7-02d, 7-03d, and 7-04c), as applicable to the respective backfill materials (see Paragraph 1-05).

(3) Payment for concrete in seep-rings and pipe bedding will be made under Item 39 (see Paragraph 11-03b).

d. Payment for gates and valves will be made under Items 32 to 34 respectively, as applicable (see Paragraph 1-05). Payment shall include floor stands, hangers and all other appurtenances.

9-03. Removing old sewer pipe (Item 35). - a. Work included. - (1* The contractor shall dig up, remove, clean and store existing sewer pipe located as shown on the drawings. Old sewer pipe shall be re-used where suitable for the purpose and approved by the contracting officer (see Paragraph 9-02).

(2) Existing sewers not entirely removed shall be plugged with concrete as shown on the drawings or as directed by the contracting officer.

b. Construction methods. - (1) Care shall be taken to avoid unnecessary breakage; any sewer pipe damaged through carelessness of the contractor while removing, hauling or storing same, will not be paid for. Only pipe acceptable to the contracting officer for re-use after cleaning (see Paragraph 9-02), shall be stored. All pipe not acceptable for re-use shall be disposed of as directed by the contracting officer.

(2) Existing sewers shall be entirely removed from the dike area as shown on the drawings, and the open ends of the remainder of the sewer shall be plugged with concrete plugs. The length of sewer to be removed shall be as directed by the contracting officer, and shall be sufficient to give proper clearance at the cut-off trench for the excavation and backfilling operations. Concrete plugs shall be placed to plug the open ends of the broken sewer on both sides of the dike and at the outlet or river end of the sewer, unless otherwise directed by the contracting officer. The minimum length of each concrete plug shall be 4 times the sewer diameter unless otherwise directed by the contracting officer. The sewer trenches under the dike shall be backfilled with compacted impervious material (see Paragraph 7-03).

c. Payment. - (1) Payment for all work in connection with

Item 35 will be made at the lump sum contract price for Item 35, "Removing Old Sewer Pipe." Payment shall include all costs for excavation, removing, cleaning and storing of pipe suitable for re-use, satisfactory disposal of pipe not suitable for re-use, installing concrete plugs, and any backfilling of trenches or other excavations incidental to the work and not included in any other item, except as modified in (2) below.

(2) Where new or larger pipe will be installed in the trench to replace the old sewer pipe removed, payment for excavation and backfilling will be made under other items, as a part of the cost of installing new pipe of larger size than that removed (see Paragraph 9-02).

9-04. Manholes (Item 36). - a. Work included. - The contractor shall construct manholes at the points indicated on the drawings, or as directed by the contracting officer.

b. Description. - (1) Manholes shall be built of brick masonry on concrete bases. The manholes shall conform in shape, size, dimensions and in other respects to the details indicated on the drawings. Excavation for the manholes shall comply with the provisions of Paragraph 4-06, as far as they are applicable.

(2) The contractor shall furnish all the materials required for the construction of the manholes, including bricks, cement, sand, hydrated lime, waterproofing compound, concrete, cast iron manhole frames, covers and steps, steel reinforcement and all other materials required. The concrete shall be Class "B" and shall comply with the provisions of Section X and Paragraph 11-03, as far as they are applicable. All steel bars used for reinforcement of concrete shall conform to the provisions of Paragraph 10-18.

c. Brick masonry. - (1) Kind of brick. - The brick shall be sound, hard and uniformly burned brick, regular and uniform in shape and size, of compact texture and satisfactory to the contracting officer. Brick shall comply with Federal Specification SS-B-691, Grade B, standard size 2-1/4 x 3-3/4 x 8 inches. In case the contracting officer rejects any brick the same shall be immediately removed from the work and brick satisfactory to the contracting officer substituted. Brick shall be culled and compactly piled as soon as delivered.

(2) Mortar for brickwork. - The mortar shall be composed of one part Portland cement and 2-1/2 parts sand, to which approximately 20 pounds of hydrated lime shall be added for each sack of cement. All mortar used shall be thoroughly mixed either by hand or in a mechanical batch mixer. Mortar shall be prepared in such quantities that it can be used entirely before it has attained its initial set. The minimum amount of water sufficient to make a workable mortar shall be used. Cement and sand used in mortar shall meet the requirements of

Paragraphs 10-05 and 10-06. The hydrated lime shall be of approved commercial quality suitable for the use intended.

(3) Brick laying. - The bricks shall be clean and shall be thoroughly wetted shortly before they are put into the wall and each brick shall be laid in a full bed and joint of mortar, without requiring subsequent grouting, flushing or filling, and shall be thoroughly bonded as directed. Brickwork shall be satisfactorily protected against weather and frost until the mortar has set.

(4) Plastering. - Outside faces of brick masonry shall be plastered with Portland cement mortar. The thickness of the cement mortar plaster shall be from 1/4 inch to 3/8 inch and the mortar shall be carefully spread and thoroughly trowelled, leaving a smooth exterior surface. The plaster shall be coated with 2 coats of approved bituminous waterproof coating brushed or sprayed on.

d. Iron castings. - (1) Quality of cast iron. - Cast iron manhole frames, covers and steps shall be as detailed on the drawings. The manhole cover and frame seats shall be machined to true plane surfaces. The castings shall be of good quality, strong, tough, even grained cast iron, smooth, free from scale, lumps, blisters, sand holes and defects of every nature which would render them unfit for the service for which they are intended. All castings shall be thoroughly cleaned and subject to careful hammer inspection. Manhole covers shall be standard, and capable of sustaining a concentrated load of 300 pounds at the center. Castings shall conform at least to the provisions of Paragraph 12-02a (8).

(2) Painting castings. - Castings before being shipped from the foundry shall be given one coat of coal tar pitch varnish applied in a satisfactory manner so as to make a smooth coating, tough, tenacious and not brittle or with any tendency to scale off.

e. Payment. - Payment will be made on the basis of the manhole unit complete. The unit contract prices for Item 36 shall include all costs for furnishing the materials, equipment and labor required to construct the manhole complete in accordance with the drawings and specifications, including excavation and backfilling (see Paragraph 4-08 f (4)).

SECTION X. CONCRETE (Items 37 to 40 incl.).

COMPOSITION, CLASSIFICATION AND STRENGTH

10-01. Composition. - Concrete shall be composed of cement, fine aggregate, coarse aggregate and water so proportioned and mixed as to produce a plastic, workable mixture in accordance with all requirements under this section and suitable to the specific conditions of placement.

10-02. Classification. - Except where required to meet special conditions all concrete shall be either Class "A" or Class "B", as designated in Section XI and on the drawings for the various parts of the work in accordance with the conditions of application and the proportions of materials and strengths required.

10-03. Strength. - The mixes will be designed to secure concrete having the following compressive strengths at the age of 28 days, as determined by breaking standard 6-inch diameter by 12-inch height or 8-inch diameter by 16-inch height test specimens:

Class	Average for any 25 consecutive cylinders	Minimum for any one cylinder
A	3400 lbs. per sq. in.	2600 lbs. per sq. in.
B	3000 lbs. per sq. in.	2200 lbs. per sq. in.

10-04. High-early-strength concrete. - High-early-strength concrete made with high-early-strength Portland cement or other special cements shall be used only when specifically authorized by the contracting officer. The 7-day compressive strength of concrete of any class, when made with high-early-strength cement, shall be at least equal to the specified minimum 28-day compressive strength for that class. All provisions of these specifications, except for cement, shall be applicable to such concrete. Any high-early-strength cement used shall be approved by the contracting officer before use.

MATERIALS.

10-05. Portland cement. (Item 37). - a. The contractor shall furnish Portland cement of the quality herein specified in sufficient quantity for the work required. Cement for all concrete, grout and mortar, except as specified in Paragraph b, shall conform to Federal Specification SS-C-206, for "Cement, Portland, Moderate-Heat-of-Hardening, September 30, 1936," except that Paragraph E-7, Heat of Hydration, shall be considered inoperative.

b. High-early-strength Portland cement. - Cement for high-early-strength concrete shall be in accordance with Federal Specifications SS-C-201 for "Cement, Portland, High-Early-Strength."

c. Special test requirements. - Cement will be tested by the Government at the Central Concrete Laboratory, West Point, N. Y. No cement shall be used until notice has been given by the contracting officer that the test results are satisfactory. Cement which has been stored, other than in bins at the mills, for more than 4 months after being tested shall be retested before use. Ordinarily, no cement shall be used until after it has satisfactorily passed both the 7 and 28-day tests, but in cases of emergency the contracting officer may waive the 28-day tests and permit the use of cement which has satisfactorily passed the soundness and 7-day tests; provided it is the product of a quarry and mill having established a reputation of not less than 3 years' standing, for the production of high-grade cement. If the tests prove any cement unsatisfactory which has been delivered at the site of the work, such cement shall be promptly removed from the work and its vicinity.

d. Identification. - Cement shipped in bags shall be positively identified by marking or tagging the bags with the identifying number or symbol of the Federal Specifications under which it was manufactured. Bulk shipments of cement shall be likewise identified by a suitable device affixed to each car or other type of bulk carrier. Marking or tagging shall be done at the mill.

e. Quality and packages. - All cement shall be dry-finely ground and free from lumps or caking. Unless otherwise permitted, the cement shall be delivered in canvas bags or other strong, well-made packages, each plainly marked with the manufacturer's brand. The weights of such bags shall be uniform. Packages received in broken or damaged condition will be rejected or accepted only as fractional packages. Cement shall be stored in a satisfactory manner so as to be unaffected by moisture, keeping each carload separate until the results of the 28-day tests are known. Suitable accurate scales shall be provided by the contractor for weighing the cement.

f. Records of cement used. - The contractor shall furnish to the contracting officer, at the end of each day's work, a statement showing in such detail as he may reasonably require the quantity of cement used during the day at each part of the work.

10-06. Fine aggregate. - a. Composition. - Fine aggregate shall be natural sand.

b. Quality. - Fine aggregate shall consist of hard, strong, durable and uncoated particles.

c. Grading. - (1) Except as provided in (2) below fine aggregate shall conform to the following requirements:

Total passing -	Per cent by weight
No. 4 sieve	95 - 100

Total passing -	Per cent by weight
No. 16 sieve	45 - 75
No. 50 sieve	10 - 25
No.100 sieve	1.5 to 7

(2) Deficiencies in the percentages of fine aggregate passing the #50 and #100 sieves, as required in the above gradation, may be remedied by the addition of pozzuolanic or cementitious materials, excepting Portland cement; provided, at least 5 per cent passes the #50 sieve and the aggregate is of proper consistent gradation within the specified limits. Such added materials, which will be considered and included as fine aggregate, shall conform to the requirements in Paragraph 10-08, and shall be in sufficient quantity to meet the minimum requirements above for percentage passing the #100 sieve and otherwise to produce the workability required by the contracting officer. The quantity and characteristics of any material used for the purpose of correcting workability shall be such that when the concrete is gaged to the proper consistency the total water content shall not exceed by more than 1 gallon per cubic yard the minimum quantity required for proper consistency when not using the admixture. The blending of any material with the original naturally graded sand to remedy deficiency in gradation shall be accomplished in charging the mixture, unless otherwise specifically authorized by the contracting officer.

d. Deleterious substances. - The substances designated shall not be present in excess of the following amounts:

	Per cent by weight
Clay lumps	1
Material removed by decantation from aggregates not more than	3
Shale	0.5

e. Mortar strength. - Mortar specimens made with the fine aggregate shall have a compressive strength at 28 days of at least 100 per cent of the strength of similar specimens made with Ottawa sand having a fineness modulus of 2.40± 0.10 and the same cement.

f. Tests. - Fine aggregate shall be subject to careful, thorough analyses, including magnesium sulphate soundness tests (see Paragraph 10-07d), to determine conformity with all requirements of these specifications.

10-07. Coarse aggregate. - a. Composition. - Coarse aggregate shall be washed gravel or crushed stone.

b. Quality. - Coarse aggregate shall consist of hard, tough and durable particles free from adherent coating. It shall contain no vegetable matter nor soft, friable, thin or elongated particles in quantities considered deleterious by the contracting officer. The substances designated shall not be present in excess of the following amounts (by weight):

Soft fragments	5%
Clay lumps	1/4%
Removed by decantation	1%

When the material removed by decantation consists essentially of crusher dirt the maximum amount permitted may be raised to 1-1/2 per cent. Aggregate which has disintegrated or weathered badly under exposure conditions similar to those which will be encountered by the work under consideration, shall not be used. When crushed stone is used the crusher shall be equipped with a screening system which will entirely separate the dust from the stone and convey it to a separate bin.

c. Size. - (1) Coarse aggregate shall be well graded from fine to coarse so that concrete of the required workability, density, and strength can be made without the use of an excess amount of sand, water, or cement.

For Class "A" concrete, required for Item 38, the maximum size mesh screen shall be not less than 1 inch.

For Class "B" concrete, required for Item 39, the maximum size mesh screen for the aggregate shall be not less than 1 inch nor more than 2 inches, unless otherwise specified.

(2) When the maximum size mesh screen is greater than 1 inch, the aggregate shall be separated, and the specified sizes delivered separately to individual proportioning hoppers, in accordance with the following:

For Maximum Size Mesh Screen, 1 in. to 2 in. inclusive:

(1) No. 4 to 1/2 maximum size mesh screen, inclusive.
(2) Over 1/2 maximum size to and including full maximum size mesh screen.

Within any of the above-indicated size-limits, not less than 85 per cent of the material shall be retained on a standard square mesh screen of the minimum size indicated and not more than 5 per cent shall be retained on a standard square mesh screen of the maximum size indicated.

(3) The grading of the coarse aggregate, in the mixed concrete, shall fall within the following limits:

	(Per cent by weight) Passing
Maximum size mesh screen (square mesh)	97 - 100
1/2 maximum size mesh screen (square mesh)	40 - 70
No. 4 sieve	0 - 6

d. Tests. - Coarse aggregate will be subjected to freezing and thawing tests and to careful, thorough analyses to determine conformity with all requirements of these specifications. Coarse aggregate will be subjected to 10 cycles of the magnesium sulphate test for soundness. No aggregate shall be used which develops a loss in excess of 10 per cent by weight.

10-08. Material added for workability. - a. The use of any material added to the mix to improve workability (see Paragraph 10-06c(2)), which, in the opinion of the contracting officer, may have an injurious effect on the strength, density, and durability of the concrete, will not be permitted. Before approval of any material, the contractor will be required to submit the results of complete chemical and sieve analyses made by an acceptable testing laboratory. Subsequent tests will be made of samples taken by the contracting officer from the supply of the material being used on the work to determine whether it is uniform in quality with that approved.

b. The material added shall be pozzuolanic, cementitious or silicious. It shall not contain effective early-heat-producing elements nor compounds, such as those contained in Portland cement, nor shall its use result in a material increase in the free-lime content of the concrete. It shall also be in conformity with the following requirements:

Free moisture - a total of not more than 3 per cent by weight.

Passing #30 sieve - not less than 100 per cent by weight.

Passing #200 sieve - not less than 85 per cent by weight.

10-09. Water. - The water used in mixing concrete shall be fresh, clean and free from injurious amounts of oil, acid, alkali, or organic matter.

10-10. Storage. - a. Cement. - Immediately upon receipt, at the site of the work, cement shall be stored in a thoroughly dry, weathertight, and properly ventilated building with adequate provisions for the prevention of the absorption of moisture. The building shall be of adequate capacity to provide for the requirements of delivery and construction schedules. Storage shall be such as to permit easy access for inspection and definite identification of each shipment.

b. Aggregates. - The fine and coarse aggregates shall be stored separately (see Paragraph 10-07 c (2)) and in such manner as to avoid the inclusion of any foreign material in the concrete. Stockpiles of coarse aggregates shall be built in horizontal layers to avoid segregation.

10-11. Sampling and testing aggregates. - Except where provided otherwise by these specifications, all sampling and testing of aggregates shall be made in accordance with the Federal Specifications. Unless specified otherwise, all test samples shall be taken under the supervision of the contracting officer and supplied to the Central Concrete Laboratory, West Point, New York, by the contractor at his expense. The source from which concrete aggregates are to be obtained shall be selected by the contractor well in advance of the time when they will be required in the work, and suitable samples as they are to be used in the concrete shall be furnished to the contracting officer at least 30 days in advance of the time when the placing of the concrete is expected to begin. The contractor shall obtain fine and coarse aggregates for concrete from approved commercial sources.

PROPORTIONING, MIXING AND PLACING

10-12. Proportioning. - a. Basis. - All concrete materials will be proportioned so as to produce a workable mixture in which the water content will not exceed the maximum specified.

b. Control. - The exact proportions of all materials entering into the concrete shall be as directed by the contracting officer. The contractor shall provide all equipment necessary to positively determine and control the actual amounts of all materials entering into the concrete. The proportions will be changed whenever in the opinion of the contracting officer such change becomes necessary to obtain the specified strength and the desired density, uniformity and workability, and the contractor will not be compensated because of such changes.

c. Measurement. - All materials shall be measured by weight except that water may be measured by volume when so authorized by the contracting officer. One bag of cement will be considered as 94 pounds in weight and 1 gallon of water as 8.33 pounds.

d. Cement content. - Each cubic yard of concrete shall contain not less than the quantity of cement stated below:

Class "A" - 5.5 bags or 517 pounds.
Class "B" - 4.5 bags or 423 pounds.

For concrete deposited in water the minimum cement content shall be 6.5 bags or 611 pounds to each cubic yard of concrete in place.

e. Water content. - (1) In calculating the total water content in any mix the amount of moisture carried on the surface of the aggregate particles shall be included. The total water content for a bag of cement for each batch of concrete shall not exceed the following:

Class "A" - 5.5 gallons or 45.8 pounds.
Class "B" - 6.5 gallons or 54.1 pounds.

In all cases, however, the amount of water to be used shall be the minimum amount necessary to produce a plastic mixture of the strength specified and of the desired density, uniformity and workability. In general, the consistency of any mix shall be that required for the specific placing conditions and methods of placement, and ordinarily the slump shall be between 1 inch and 3 inches when tested in accordance with the current specifications for "Method of Test for Consistency of Portland Cement Concrete," of the American Society for Testing Materials.

(2) An increase in the maximum water content, based only on the requirements of materials added in accordance with Paragraph 10-06c to improve workability will not be permitted unless comparative tests under job conditions show conclusively that such increase in water content will not result in a decrease in concrete strength and provided further that such increase does not exceed 1 gallon per cubic yard.

f. Aggregate content. - The total volume of aggregates to be used in each cubic yard of concrete shall be that necessary to produce a dense mixture of the required workability as determined by the contracting officer.

10-13. Mixing and placing. - a. Equipment. - Concrete shall be mixed in approved mechanical mixers of a rotating drum type, except that if permitted relatively small quantities may be mixed by hand in a satisfactory manner. Concrete shall be mixed at all times by competent and experienced men. The contractor shall provide at the site of the work a modern and dependable batch type mixing plant with a minimum capacity of 100 cubic yards of concrete per 8 hours. The plant shall include not fewer than two complete mixers with separate power plants, having a minimum capacity of 1/2 cubic yard each. The equipment shall provide adequate facilities for the accurate measurement and control of each of the materials entering the concrete. The complete plant assembly, including provisions to facilitate the inspection of all operations at all times and the adequacy and dependability of each of its parts shall be subject to the approval of the contracting officer and shall conform to the following requirements:

(1) It shall be capable of ready adjustment for compensating for the varying moisture content of the aggregates and for changing the proportionate batch weights.

(2) It shall be capable of controlling the delivery of all material within 1 per cent by weight of the specified amounts.

(3) It shall be arranged to permit the convenient removal of the material in excess of the specified tolerances.

(4) It shall include a visible dial or any suitable device which will accurately register the scale load at any stage of the weighing operations from zero to full capacity.

(5) The accuracy of the weighing equipment shall conform to the requirements of the U. S. Bureau of Standards and shall be tested monthly or otherwise when required at the expense of the contractor.

(6) It shall include a device for accurately measuring and indicating the quantity of water entering the concrete, and the operating mechanisms must be such that no leakage will occur when the valves are closed.

(7) It shall include a device for accurately and automatically measuring and indicating the time required for mixing, which may be interlocked to prevent the discharge of concrete from the mixer before the end of the mixing period.

(8) It shall include a device for properly recording and indicating the number of batches handled.

b. Time. - The minimum time for mixing each batch, after all materials are in the mixer, shall be as follows:

1/2 to 1-1/2 cubic yard mixer	1-1/2 minutes
Larger than 1-1/2 cubic yard mixer	2 minutes

The mixer shall revolve a minimum of 12 revolutions after all materials have been placed in it, and at a uniform speed. Neither speed nor volume capacity of the mixer shall exceed those recommended by the manufacturer. Excessive overmixing, requiring additions of water to preserve the required consistency, will not be permitted.

c. Conveying. - Concrete shall be conveyed from mixer to forms as rapidly as practicable, by methods which will prevent segregation or loss of ingredients. It shall be deposited as nearly as practicable in its final position. Conveying of concrete by means of chutes will not be permitted except for short chutes in the forms to distribute the concrete. Chutes used shall be such that the concrete slides in them and does not flow. Chutes with a flatter slope than 1 on 2 will not be permitted. There shall be no free vertical drop greater than 5 feet except where specifically authorized by the contracting officer.

d. Placing. - (1) Concrete shall be placed before initial set has occurred, and in no event after it has contained its water content for more than 45 minutes.

(2) Unless otherwise specified, all concrete shall be placed in the dry upon clean, damp surfaces, free from ice, frost or running water, and never upon soft mud, dry porous earth, or upon fills that have not been subjected to approved rolling, puddling or tamping so that ultimate settlement has occurred.

(3) Rock surfaces upon which concrete is placed shall be approximately horizontal or stepped, rough, and free from loose material or other matter interfering with a satisfactory bond. The rock shall be washed, scrubbed with steel brushes or brooms, and spread with a layer of mortar about 1/2 inch thick, immediately before the concrete is placed. The mortar shall be of the same cement-sand ratio as used in the concrete.

(4) Unless otherwise specifically authorized or directed, concrete in mass structures shall be placed in monoliths not exceeding 40 feet in length or width. The layout of all monoliths shall be as directed or approved by the contracting officer before concreting is commenced.

(5) All concrete shall be deposited in approximately horizontal layers not to exceed 24 inches in thickness unless otherwise specifically authorized or directed by the contracting officer and the concreting shall be carried on as a continuous operation, as far as practicable, until the placing in the course, section, panel or monolith is completed. Unless otherwise shown on the drawings, courses shall generally have a minimum thickness of 4 feet, and a maximum of 18 feet, except that in hot weather the contracting officer may direct the maximum be reduced to 8 feet. A minimum time interval of 48 hours shall be allowed between successive courses for the dissipation of heat of hydration.

(6) Concrete shall be placed with the aid of mechanical vibrating equipment as approved by the contracting officer. Vibration shall be transmitted directly to the concrete, and in no case shall it be transmitted through the forms. The frequency of vibration shall be not less than 5000 per minute. The intensity of vibration shall be sufficient to cause flow or settlement of the concrete into place. The vibration shall be of sufficient duration to accomplish thorough compaction as approved by the contracting officer. Vibration shall be supplemented by forking or spading by hand adjacent to the forms on exposed faces in order to secure smooth, dense, even surfaces. The concrete shall be compacted and worked in an approved manner into all corners and angles of the forms and around reinforcement and embedded fixtures.

(7) In dropping concrete through reinforcement, care shall be taken that no segregation of the coarse aggregate occurs. On flat surfaces, where the congestion of steel near the forms makes placing difficult, a mortar of the same cement-sand ratio as is used in the concrete shall be first deposited to cover the forms.

(8) All top surfaces not covered by forms and which are not to be covered by additional concrete or backfill shall be carried slightly above grade and struck off by board screed (see Paragraph 10-15).

e. Construction joints. - Vertical joints shall be formed with tongue-and-groove bonds or keys at such locations and of such shapes and dimensions as approved or directed by the contracting officer. Horizontal joints shall be formed with keys, or, where horizontal pressure is always in one direction, with steps. Where required, dowel rods shall be used. All concrete in vertical members shall have been in place not less than 12 hours, and longer if so directed by the contracting officer, before concrete in horizontal members resting thereon is placed. As soon as practicable after placing and immediately before placing the succeeding layers is resumed, all approximately horizontal surfaces shall be washed with a high pressure air-and-water jet or cleaned as otherwise directed by the contracting officer. Sand shall be added to the air-and-water jet when required, to remove alkali, algae, stains, and other substances injurious to the bond. The time and method of using the jet shall be such that all laitance, scum, etc. will be removed so that partly embedded aggregate is not disturbed and is washed clean. After final cleaning and immediately before placing is resumed, the surfaces shall be wetted and spread with a layer of mortar 1/2 inch thick, thoroughly brushed in. The mortar shall be the same cement-sand ratio as the concrete. Where specified or otherwise required by the contracting officer for watertight construction, copper strips not less than 18 inches in width and weighing not less than 20 ounces per square foot, properly crimped or bent, shall be placed in the concrete to span the joint.

f. In water. - When specifically authorized, concrete may be deposited in water having a temperature above 45 degrees F. The methods and equipment used shall be subject to the approval of the contracting officer. When deposited by the tremie method, the tremie shall be watertight and sufficiently large to permit a free flow of concrete. The discharge end shall be kept continuously submerged in the concrete and the shaft kept full of concrete to a point well above the water surface. When the bottom-dump-bucket method is used, the bucket shall not be dumped until after it has come to rest on the surface upon which the concrete is to be deposited. The bucket shall be provided with a suitable cover, and the bottom doors, when tripped, shall open freely. The bucket shall be completely filled and slowly lowered in order to avoid backwash, and when tripped it shall be slowly withdrawn until entirely free of the concrete. With either method, concreting shall proceed without interruption until the top of the concrete is well above the water surface.

g. Cold weather. - Concrete shall not be placed when the ambient atmospheric temperature is below 35 degrees F., nor when the concrete is likely to be subject to freezing temperatures before final

set has occurred, unless specifically authorized by the contracting officer in writing. When so authorized, the materials shall be heated in order that the temperature of the concrete, when deposited, shall be not less than 50 degrees F. nor more than 70 degrees F. All methods and equipment for heating shall be subject to the approval of the contracting officer.

h. Hot weather. - For concrete placed during the extremely warm summer months and otherwise, when directed by the contracting officer, the aggregates shall be cooled by frequent spraying in such manner as to utilize the cooling effect of evaporation. During such periods the placement schedule shall be arranged as approved by the contracting officer in such manner as to provide time for the temperature of the previously placed course to begin to recede. The mixing water shall be the coolest available at the site insofar as is practicable.

10-14. Test specimens. - a. Number. - Test specimens, to determine whether the compressive strength of the concrete is in accordance with that specified in Paragraph 10-03, will be taken by the inspector. At least 1 set of 3 specimens will be made for every major pour and in general for every 100 cubic yards of concrete placed, but in any event, a sufficient number of specimens will be taken to give a comprehensive knowledge of the concrete in each section of the work.

b. Method. - All specimens will be taken from the concrete at the mixing plant. The specimens will be tested by the Government at the Central Concrete Laboratory, West Point, New York. All costs of transportation and testing of specimens will be borne by the Government.

10-15. Finishing. - Immediately after placement, the concrete shall be properly forked back along the faces of all forms by the use of standard concrete forks or spades unless otherwise specifically authorized or directed by the contracting officer. The finished surfaces shall be free from sand streaks or other voids and the plastering over of such surfaces will not be permitted. Defective concrete shall be repaired by cutting out the unsatisfactory material to a depth of not less than 2 inches and placing new concrete which shall be formed with keys, dovetails or anchors to attach it securely to the other work. One anchor shall be placed for each 64 square inches of area and the sides of the cut areas shall be generally rectangular. This concrete shall be drier than the usual mixture and shall be thoroughly tamped into place behind forms securely fastened. Unless otherwise specified, all surfaces of concrete not covered by forms, that are not to be covered by additional concrete, or backfill, shall have a wood float finish without additional mortar, and shall be true to elevations as shown on the drawings. Care shall be taken to see that all excess water is removed before making this finish. Other surfaces shall be brought to the specified finished elevation and left true and regular as approved by the contracting officer. Where considered necessary by the contracting

officer, or where indicated on the drawings, joints shall be carefully made with a jointing tool. Every precaution shall be taken by the contractor to protect finished surfaces from stains or abrasions. No fire shall be permitted in direct contact with any concrete at any time. Concrete surfaces or edges likely to be injured during the construction period, shall be properly protected by leaving the forms in place, or by erecting covers satisfactory to the contracting officer.

10-16. Curing. - a. Warm weather. - All concrete shall be adequately protected from injurious action by the sun. Fresh concrete shall be protected from heavy rains, flowing water, and mechanical injury. All concrete shall be kept wet for a period of not less than 14 days by covering with water, or with an approved water-saturated covering, or by a system of perforated pipes or mechanical sprinklers, or any other approved method which will keep all surfaces continuously (not periodically) wet. Where wood forms are left in place for curing, they shall be kept wet at all times to prevent opening at the joints and drying out of the concrete. Water for curing shall be generally clean and entirely free from any elements which in the opinion of the contracting officer might cause staining or discoloration of the concrete.

b. Cold weather. - Concrete when placed during cold weather shall be kept moist and provided with adequate protection for a period of not less than 14 days, subject to the approval of the contracting officer, so that the air in contact with the concrete will be maintained at temperatures between 50 degrees F. and 70 degrees F. for at least the first 5 days of the curing period. For massive sections, where the atmospheric temperatures are sufficiently low in the opinion of the contracting officer to cause excessively rapid cooling and contraction of the exterior surfaces, this period for maintaining the temperature of the air in contact with the concrete between 50 and 70 degrees F shall extend over the entire curing period. Salt or other chemicals shall not be admitted into the mixture to prevent freezing except with the approval of the contracting officer.

FORMS, REINFORCEMENT AND PAYMENT

10-17. Forms. - a. Materials. - Forms shall be of wood, steel or other approved material, except that where lining is not specified, the sheeting for all exposed surfaces shall be tongue-and-groove lumber of uniform width unless otherwise specifically authorized. Forms of like character shall be used for similarly exposed surfaces in order to produce a uniform appearance. The type, size, shape, quality and strength of all materials of which the forms are made shall be subject to the approval of the contracting officer.

b. Construction. - Forms shall be built true to line and grade, and shall be mortar-tight and sufficiently rigid to prevent displacement or sagging between supports. Responsibility for their adequacy shall rest with the contractor. Their surfaces shall be smooth

and free from irregularities, dents, sags, or holes when used for permanently exposed faces. Bolts and rods used for internal ties shall be so arranged that, when the forms are removed, all metal will be not less than 2 inches from any concrete surface. Wire ties will not be permitted where the concrete surface will be exposed to weathering and discoloration will be objectionable. All forms shall be so constructed that they can be removed without hammering or prying against the concrete. Unless otherwise indicated, suitable moldings shall be placed to bevel or round exposed edges, at expansion joints or any other points as may be required by the contracting officer.

c. Coating. - Forms for exposed surfaces shall be coated with a non-staining mineral oil which shall be applied shortly before the concrete is placed. Forms for unexposed surfaces may be thoroughly wetted in lieu of oiling, immediately before the placing of concrete, except that in freezing weather oil shall be used.

d. Removal. - Forms shall not be removed without the approval of the contracting officer, and all removal shall be accomplished in such manner as will prevent injury to the concrete. Forms shall not be removed before the expiration of the minimum number of days indicated below, except when specifically authorized by the contracting officer. When, in the opinion of the contracting officer, conditions on the work are such as to justify it, forms may be required to remain in place for longer periods.

Arches, beams and slabs	14 days
Columns	7 days
Walls and vertical faces	2 days

e. Form lining. - In addition to the requirement for work specified above, wood forms for walls which will be visible in the finished structure, and at other locations indicated on the drawings or as directed by the contracting officer, shall be lined with sheet steel or with pressed wood sheets similar to Masonite or approved equal. Lining shall be applied directly to the sheeting. The jointing of the lining shall be neat and close and no patch pieces, plugs, cleats or blocking will be permitted. Overrun of lining shall be trimmed to secure proper fit to adjoining surfaces. Lining with bruises, imprints or hammer marks shall not be used.

10-18. Furnishing, bending, and placing steel reinforcement. - (Item 40). - a. Work included. - (1) The contractor shall furnish, cut, bend and build into the concrete, in accordance with the drawings and directions, all reinforcing steel of deformed bars, dowels or anchors.

(2) Steel reinforcement may be cut and bent at the mill or in the field. All bending shall be in accordance with standard approved practice and by approved machine methods.

b. Materials. - Reinforcing steel shall be of new, billet intermediate grade, open-hearth steel, deformed, and shall conform to Federal Specification QQ-B-71A for "Bars, Reinforcement, Concrete," "Type B", Grade 2. If available, certified copies of any mill test shall be furnished by the contractor and the steel shall be subjected to such tests as the contracting officer may consider necessary to establish its quality, including particularly the requirements of bending and elongation. The steel shall be free from oil, paint, dirt or excessive rust.

c. Placing. - (1) All steel reinforcement shall be placed in the exact positions and with the spacing shown on the drawings or ordered, and it shall be so fastened in position as to prevent its becoming displaced during the placing of the concrete. The clear distance between parallel rods shall be not less than one and one-half times the diameter of round rods, or twice the side dimensions of square rods, and unless specifically authorized, shall in no case be less than 1 inch.

(2) Except where otherwise indicated, reinforcement shall be placed as follows:

(a) All main reinforcement shall be placed not less than 4 inches from any surface, except in slabs and in buildings.

(b) All main reinforcement in walls, in slabs or buildings exposed to the weather and in fire-resistant construction, shall be placed not less than 1 inch from the surface in walls and slabs, 1-1/2 inches in floor beams and 2 inches in girders and columns. The covering of stirrups, spacer rods, and similar secondary reinforcement may be reduced by the diameter of such rods. The above dimensions shall be measured from the face of the reinforcement to the face of the forms.

(c) Where splices in reinforcement, in addition to those indicated are necessary, there shall be sufficient lap to transfer the stress by bond as may be directed. Rods shall be lapped not less than 40 diameters and splices shall be staggered. The lapped ends of rods shall be separated sufficiently or connected properly to develop the full strength of rod. Adjacent sheets of mesh reinforcement shall be spliced by lapping not less than 6 inches, the lapped ends being securely wired together.

d. Protection. - Steel for reinforcement shall be new unrusted stock, free from loose scale. It shall be at all times satisfactorily protected from moisture until placed in final position. Ends of rods that are to be left projecting for a considerable time shall be painted with a heavy coat of neat cement grout.

10-19. Embedded items. - In addition to reinforcing steel, there shall be built into, or set, or attached to the concrete, gates, pipes,

catch-basin and manhole frames and covers, and other metal objects as shown on the drawings or ordered. All necessary precautions shall be taken to prevent these objects from being displaced, broken or deformed. Before placing concrete, care shall be taken to determine that any embedded metal or wood parts are firmly and securely fastened in place as indicated. They shall be thoroughly clean and free from paint or other coating, rust, scale, oil, or any foreign matter. The embedding of wood in concrete shall be avoided whenever possible, metal being used instead. The concrete shall be packed tightly around pipes and other metal work so as to prevent leakage and secure perfect adhesion. Drains shall be adequately protected from intrusion of concrete into them. Payment for this work is included in the several items for drains and metal work.

10-20. Expansion and contraction joints. - Expansion and contraction joints shall be constructed true to line and grade at such points and of such dimensions as may be indicated or required. The method and materials used shall be subject to the approval of the contracting officer and the materials shall conform to Federal Specifications wherever applicable. Unless otherwise indicated on the drawings, or required by the contracting officer, expansion joints shall be made by coating concrete surfaces with two coats of approved asphaltic emulsion or a single coat of bituminous cement. In no case shall corner protection angles or other fixed metal embedded in the surface of the concrete and bonded, be continuous through an expansion joint.

10-21. Measurement and payment. - a. Portland cement (Item 37). - (1) The quantity to be paid for under Item 37 will be the number of barrels of cement used in all parts of the work unless specifically excepted. For purposes of payment, a barrel of cement shall be considered 376 pounds net of cement. The unit contract price for the cement shall include payment for all expenses incidental to delivering the cement upon the work in which it is to be used.

(2) Only the cement furnished for work to be done under Items 38 and 39 will be paid for under Item 37. Cement used for mortar or grout under other items will be included in the payment for those items.

(3) Partial payment at the rate of 80 per cent of the unit contract price will be made for cement delivered at the site but not installed in the work, provided it has been accepted for use and is stored or protected in a manner satisfactory to the contracting officer. The remainder of the contract price, less retained percentage, if any, will be paid when the cement has been incorporated in the work as required by the specifications. Proper deductions will be made in subsequent estimates for any partial payments made for cement not used in the work.

b. Concrete (Items 38 and 39) - See Section XI.

c. Reinforcement (Item 40). - (1) The quantity to be paid for under Item 40 will be the number of pounds of steel placed in accordance with the drawings or orders, measured as specified. It will not include any waste material due to the face that the lengths supplied are too long for their purpose. The quantity paid for will, however, include extra metal in laps, where authorized, due to the fact that single bars would be unreasonably long. In computing the weights, the theoretical weight of plain bars will be used as tabulated in Federal Specifications QQ-B-71a for the lengths ordered. Wire or metal clips, and other supports necessary to hold the steel in place will not be considered as reinforcement but shall be furnished by the contractor without additional compensation. The unit contract price for Item 40 shall include the furnishing, bending, cutting, placing, fastening in position, coating and protecting the reinforcement and all other work and materials connected therewith (see Paragraph 10-18a).

(2) Partial payment at the rate of 50 per cent of the unit contract price will be made for steel reinforcement delivered at the site but not installed in the work, provided it has been accepted for use and is stored or protected in a manner satisfactory to the contracting officer. The remainder of the contract price, less retained percentage, if any, will be paid when the steel reinforcement has been incorporated in the work as required by the specifications. Proper deductions will be made in subsequent estimates for any partial payments made for steel reinforcement not used in the work.

SECTION XI. CONCRETE STRUCTURES (Items 38 and 39)

11-01. General. - a. Description. - Concrete structures shall be constructed as shown on the drawings and in accordance with modifications designated by the contracting officer. Concrete shall conform to all the requirements of Section X for concrete of the class specified. Surfaces of concrete shall be finished as specified in Paragraph 10-15, except as otherwise specified in this section or indicated on the drawings.

b. Measurement and payment. - The quantity to be paid for under Items 38 and 39, will be the number of cubic yards of concrete satisfactorily placed within the required limits. No deductions shall be made for openings having a cross-sectional area less than that of a 12-inch pipe, nor for the space occupied by reinforcing steel, miscellaneous metal, wood nailing strips, or by other materials required to be built into the concrete. The unit contract prices shall include payment for all costs of furnishing materials, erecting and removing forms, mixing and placing concrete, except that cement, reinforcing steel and other metal work are included under other items. (See Paragraph 10-21.)

11-02. Concrete in flood wall (Item 38). - a. Description. - This classification includes the Class "A" concrete for the flood wall, placed between the limiting lines and grades, and in the required location, as shown on the drawings or directed by the contracting officer. Forms for exposed surfaces shall be lined with pressed wood, "Masonite" or equal. Concrete fins formed on exposed surfaces shall be removed after the forms are stripped. Piping and miscellaneous metal work shall be set and concreted in place as provided for on the drawings. The existing timber bulkhead shown on the drawings, shall be maintained throughout construction.

b. Measurement and payment. - The volume of concrete to be paid for will be the volume computed between the limiting lines and grades, as shown on the drawings or directed by the contracting officer. The unit contract price shall include payment for Class "A" concrete placed under Item 38, "Concrete in Flood-Wall".

11-03. Concrete in miscellaneous structures (Item 39). - a. Description. - This classification includes the Class "B" concrete for culvert head walls, wing walls and aprons, valve chambers, catch basins, seep rings and all other Class "B" concrete in miscellaneous structures, not included in any other item, placed between the limiting lines and grades, and in the required locations, as shown on the drawings or directed by the contracting officer. Concrete fins formed on exposed surfaces shall be removed after the forms are stripped. Piping and miscellaneous metal work shall be set and concreted in place as provided for on the drawings. Bituminous water-proofing shall be applied to the outside surfaces of all valve chambers and catch basins (see Paragraph 9-04c(4)).

SECTION XII. METALS AND EMBEDDED ITEMS (Items 41 to 43 incl.)

12-01. General. - a. All metals, unless otherwise specified, shall conform to applicable Federal Specifications, and, when not covered thereby, to applicable A.S.T.M. specifications. All castings shall have the pattern or mark number cast on them. Unless otherwise authorized by the contracting officer the scale weights of each casting or forging after machining shall be within 5 per cent of the weights as calculated from the dimensions specified or shown on the drawings. Castings shall conform, at the minimum section thereof, to the following dimensional tolerances: where embedded in concrete, to within 1/8 inch; where not embedded in concrete, to within 1/16 inch of the dimensions shown on the drawings.

b. The various articles shall be furnished and placed as indicated on the drawings, unless otherwise directed by the contracting officer. The more important articles required are listed below and are required at the flood wall, valve chambers and catch basins, or elsewhere, but other articles, whether or not shown on the drawings, becoming necessary in the development of detailed plans and satisfactory construction, shall also be furnished; except materials and fittings specifically included under other items of the work.

12-02. Materials and workmanship. - a. The articles included in Items 41 to 43 inclusive, other miscellaneous materials, and all metals required in the work except as otherwise specified, shall meet the requirements of the following specifications where applicable to the use intended.

(1) Structural steel, refer to Federal Specifications QQ-S-711a; shapes, plates, bars, pins and bolts shall be Class "A" and rivets shall be Class "C", unless otherwise required. Welding will be accepted only where specified or authorized, and approved only when done in accordance with the current requirements of the American Bureau of Welding.

(2) Cold-rolled steel, refer to A.S.T.M. Specifications A-108-36 for "Commercial Cold-finished Bar Steels and Cold-finished Shafting." Unless otherwise specified this material shall be used for rods, pins, keys and similar parts.

(3) Hot-rolled steel, for shafting, sleeves and rollers, refer to A.S.T.M. Specifications A-107-36 for "Commercial Quality Hot-rolled Bar Steels."

(4) Machine steel, same as for Hot-rolled steel.

(5) Steel, corrosion resisting, refer to U. S. Navy Specification 46-S-18b.

(6) Steel forgings, shall be of hot-rolled open-hearth steel forging bars conforming to A.S.T.M. Specifications A-18-30 for carbon steel and alloy steel forgings, Class "C", except that shafts of this material not otherwise specified shall be S.A.E. No. 1045 hot-rolled, open-hearth steel forging bars.

(7) Steel castings, refer to Federal Specifications QQ-S-681a.

(8) Iron castings, gray, refer to Federal Specifications QQ-I-651, class as indicated. Tensile tests and chemical analysis will not be required.

(9) Iron castings, semi-steel, refer to Federal Specifications QQ-I-656 for "Iron Castings, High Test (semi-steel)", class as indicated. Tensile tests will not be required.

(10) Malleable iron castings, refer to Federal Specifications QQ-I-666, Type "A".

(11) Steel rail track and fittings, shall be standard A.S.C.E. sections and shall conform to the A.R.E.A. standard specification for carbon steel rails.

(12) Chains and attachments, refer to Federal Specifications RR-C-271 of Type "A" and Grade "2" unless otherwise specified.

(13) Bolts, screws, and washers, refer to appropriate Federal Specifications and current standard practice, unless otherwise specified.

(14) Wrought-iron bars and shapes, refer to Federal Specifications QQ-I-686, Grade "B".

(15) Cast-iron pipe, refer to A.S.T.M. Specifications A-44-04 Class A; for soil pipe refer to Federal Specifications WW-P-401.

(16) Black steel pipe, refer to Federal Specifications WW-P-403, Type A, and WW-P-521.

(17) Sheet copper, refer to Federal Specifications QQ-C-501, Type V, Class A.

(18) Zinc coatings (hot galvanized), refer to Federal Specifications QQ-I-696.

(19) Babbitt metal, refer to Federal Specifications QQ-M-161.

(20) Lead, refer to Federal Specifications QQ-L-171, Grade A.

(21) Solder, refer to appropriate Federal Specifications QQ-S-571 and QQ-S-551.

(22) Valves, refer to Federal Specifications WW-V-76a, unless otherwise specified or shown on the drawings.

(23) Other items, unless otherwise specified, shall conform to current standard practice for the material required and use intended.

12-03. Glavanizing and painting. - a. Glavanized iron or steel articles shall be galvanized by the hot-dip process unless otherwise permitted. Injuries to the galvanizing shall be satisfactorily repaired. Provision shall be made for protecting threads either by counter-boring fittings, so as to cover threads or by cutting threads so as to make a very loose fit before galvanizing and carefully rerunning threads after galvanizing so as to leave a good coating all over threads. Hot galvanizing shall be of such quality as to endure at least 4 one-minute immersions in copper sulpahte solution, in accordance with the requirements of the Preece test.

b. All metal to be exposed in the finished work shall be thoroughly cleaned and then thoroughly and evenly painted with one coat of red lead paint and two coats of an approved lead-and-oil paint to the satisfaction of the contracting officer. No painting shall be done until the condition of the surface to be painted has been approved. The paint shall be applied by either brush or spray in a neat, thorough, and workmanlike manner, and in no event shall any paint be applied in freezing, rainy, or misty weather. The paint used shall conform to the requirements of Federal specifications of Group "TT"; and samples of paint shall be submitted to the contracting officer for approval and selection.

12-04. Miscellaneous structural steel (Item 41). - a. The structural steel gate in the concrete flood wall and other required structural steel items shall be furnished and installed as shown on the drawings. Miscellaneous structural steel shapes shall be provided and installed as shown on the drawings, and shall be securely anchored to the concrete structures as directed by the contracting officer.

b. Payment will be made as specified in Paragraph 12-06b.

12-05. Miscellaneous iron and steel (Item 42). - a. Culvert frames and gratings strainers, floor drains, ladders, turnbuckles, pipesleeves and anchors shall be furnished and installed. General requirements are as follows:

(1) Ladder rungs, hand grabs, and ladders shall be of open-hearth steel, shop bent or manufactured.

(2) Two 4-inch strainers, similar or equal to the Josan type, No. 454G, and one 4-inch floor drain with backwater valve,

similar or equal to the Crane Co. type, No. C34818, shall be furnished and installed in the valve chambers as shown on the drawings.

(3) All miscellaneous anchors shall be wrought iron.

b. Payment will be made as specified in Paragraph 12-06b.

12-06. Copper water stops (Item 43). - a. Copper water stops required for the expansion joints of concrete work shall be furnished and installed. Copper water stops used in concrete expansion joints shall be continuous, and shall be crimped. Splicing of the water stops shall be done by overlapping, riveting and copper welding. Unless otherwise specified on the drawings the material shall be 20-ounce sheet copper of approved standard. The crimp shall be filled with a mastic filler of "elastite," as manufactured by Philip Carey Co., Cincinnati, Ohio, or equal. Copper water stops shall be placed in the expansion joints indicated on the drawings, as directed by the contracting officer.

b. Measurement and payment. - The quantities to be paid for under Items 41 to 43, inclusive, will be the number of pounds respectively furnished and installed in accordance with the drawings and specifications. Wherever practicable, the quantities shall be determined by weighing the articles and materials on the most accurate scales available. When weighing is not practicable, the actual weight of each part or item involved will be determined by the contracting officer, who will use for that purpose scale weights, railroad shipping weights, manufacturers' weights, catalog weights, and estimated weights. The weight of all tare, packing, and blocking will be deducted, using only net weights for payment quantities; provided, that no payment will be made for any weight in excess of 5 per cent more than the computed weight as determined from the drawings.

SECTION XIII. MISCELLANEOUS (Items 44 to 53 incl.)

13-01. Placing topsoil and sodding embankment slope (Items 44 and 45). - a. Work included. - The contractor shall furnish and place topsoil on the slopes of the earth dike as shown on the drawings, and on other areas as required by the contracting officer. The finished embankment dimensions shall be as shown on the drawings. Under Item 44, acceptable topsoil shall be placed to the required depth over the required areas. Under Item 45, the prepared topsoil surface shall be sodded and seeded when and as directed by the contracting officer.

b. Placing topsoil. - After the earth dike has been completed to the required height and dimensions, the contractor shall apply the stored topsoil (see Paragraph 4-04 a (2)) or additional acceptable topsoil if necessary, to the required depth when compacted, over the slopes of the embankment to the limits shown on the drawings. The topsoil shall be lightly rolled or tamped and any unevenness of surface shall be corrected to conform to finished grades.

c. Sodding. - (1) The slopes of the earth dike shall be planted by spot sodding with living sods of Bermuda or some other acceptable grass which will best meet the climatic conditions as approved by the contracting officer. Sods obtained by stripping operations (see Paragraph 4-04 a (2)) may be used if approved by the contracting officer. Each sod shall have an area of not less than 16 square inches. Sods shall be placed not more than 18 inches center to center for the minimum-sized sods; larger sods may be spaced proportionately, depending on their size. Sods shall be covered with one-half to one inch of earth, in such manner as to protect the roots from drying out. Sods shall be placed as soon as practicable after cutting, and newly placed sods shall be kept moistened by sprinkling when and as required by the contracting officer for the entire period of the contract.

(2) Sodding shall be commenced immediately upon completion of the dike to final grade and cross section and shall be prosecuted at a rate satisfactory to the contracting officer. Seeding shall be done to supplement the sodding operations.

d. Seeding. - (1) Preparation. - All grass or cover crop seed shall be sown at the earliest practicable date in the spring, or when directed by the contracting officer, so as to secure the greatest possible protection against erosion. The finished surface grade of the slopes shall be maintained in a true and even condition during the seed-sowing operation, and the contractor shall rake the soil to a depth of three-quarters of an inch (3/4") by using iron rakes immediately previous to sowing seed. All raking shall be done in a direction parallel to the contour lines on the slope and not uphill or downhill. All sticks, stones, woods or trash appearing on the surface shall be removed.

(2) Seed mixture. - The following mixture will be approved for each acre of seeding:

Perennial Rye Grass	7 lbs.
Orchard Grass	15 lbs.
Hard Fescue	4 lbs.
Kentucky Blue	6 lbs.
Sheep Fescue	6 lbs.
Timothy	7 lbs.
Perennial Red Clover	4 lbs.
White Clover	4 lbs.
Red Top	7 lbs.
Total per acre	60 lbs.

For all seeded areas, about 15 pounds of oats per acre shall be added if the planting is done between the middle of June and the middle of September, and about 15 pounts of winter rye per acre shall be added if the planting is permitted and done in the late season after the middle of September.

(3) Method of seeding. - The contractor shall take advantage of favorable weather and shall employ a method of sowing satisfactory to the contracting officer. The seed shall be raked in and the whole surface then lightly rolled. Seeding shall be done immediately after the preparation of the earth surface unless otherwise directed. If there be any delay, and if weeds grow in and with the grass, such weeds shall be cut before they go to seed or at such time as directed by the contracting officer. If any loam is washed away or any portions of the seeded areas are not covered by grass, the contractor shall replace the topsoil, fertilize and re-seed.

(4) Maintenance. - The contractor shall maintain the areas sown to grass seed on each section of the project, until all work on the entire contract has been completed and accepted by the contracting officer. This maintenance shall consist of occasional mowing with a scythe or mechanical mower, watering during periods of drought, and removal of conspicuous weeds, or any other similar operations whenever required by the contracting officer. The turf areas shall be fertilized with an acceptable commercial lawn fertilizer of a quality equal to Vigoro or Scott's lawn fertilizer at the customary quantity per acre recommended by the manufacturer.

c. Measurement and payment. - (1) The quantity of topsoil to be paid for under Item 44 will be the number of cubic yards actually placed in accordance with directions, measured after compacting, whether obtained from stockpiles or from other sources at the expense of the contractor. Payment shall include the costs of all labor, materials and expenses incidental to furnishing and placing the topsoil. Payment will be made at the contract unit price for Item 44, "Topsoil on Embankment."

(2) The quantity to be paid for under Item 45 will be the number of acres sodded and seeded as directed. The measurement will be the actual superficial areas sodded and seeded. Payment shall include all costs for sodding and seeding as specified in subparagraphs c and d above, and for all materials and expenses incidental thereto. Payment will be made at the contract unit price for Item 45, "Sodding and Seeding."

13-02. Surfacing for top of dike (Item 46). - a. Work included. - The contractor shall furnish and place gravel of the sizes and quality specified or directed with a clay binder for the surfacing of the top of the dike, and elsewhere on ramps, as shown on the drawings or as directed by the contracting officer.

b. Material. - The gravel shall be composed of hard, durable stones, free from thin or elongated pieces, and mixed with sand and clay or other approved binding material. The gravel shall be of such sizes that all will pass through a screen with 3/4" square openings, and not less than 35 per cent will be retained on a screen with 1/4" square openings, and shall be uniformly graded. The finer material shall consist of sand and clay or other binding material approved by the contracting officer. Should the material as received for the work fail to maintain suitable proportions of coarse and fine particles, or should the coarse particles not be uniformly graded between the maximum and minimum sizes as specified, it shall be screened or manipulated in such a manner as to furnish a material to meet the above requirements.

c. Placing. - (1) The gravel surfacing shall be placed in one layer, and shall be 6" thick after compaction. After the subgrade or foundation shall have been properly prepared and compacted and proper drainage provided, the material shall be spread evenly by means of approved spreader vehicles or trucks. The material as spread shall be well-graded with no pockets of fine material or segregation of coarse and fine particles. After being spread evenly, the material shall be graded and compacted to the required thickness, by successive trips of a 10-ton 3-wheel road roller, until a firm even surface is obtained. If at any time the material does not contain a sufficient amount of moisture to insure proper binding of the material, water shall be added by means of a sprinkling wagon or any approved method in a sufficient amount to obtain the desired results.

(2) Compacting of the material shall start longitudinally at the side and gradually proceed toward the center of the roadway so far as practicable, overlapping on successive trips. During the process of compacting the material shall be dragged; the dragging and compacting shall continue until the surfacing does not creep or wave under traffic.

d. Shoulders. - Shoulders shall be constructed as shown on the drawings and carefully maintained. Before the final completion of the work the shoulders shall be reformed, trimmed, and dressed as required by the contracting officer.

c. Measurement and payment. - The quantity to be paid for under Item 46 will be the number of cubic yards of gravel surfacing furnished in accordance with directions within the limits designated, measured in place after compacting. Payment will be made at the contract unit price for Item 46, "Surfacing for Top of Dike." The unit contract price shall include payment for all expenses incidental to furnishing, placing, and compacting the gravel.

13-03. Gravel for roads (Item 47). - a. Work included. - The contractor shall furnish and place gravel of the sizes and quality specified or directed with a clay binder for the surfacing and shoulders of roadways, to the lines and grades shown on the drawings.

b. Material. - The gravel shall be composed of hard, durable stones, free from thin or elongated pieces, and mixed with sand and clay or other approved binding material. The gravel shall be of such sizes for the bottom course that all will pass a screen with 3" square openings and not less than 40 per cent will be retained on a screen with 1/4" square openings; and for the top course all will pass through a screen with 3/4" square openings, and not less than 35 per cent will be retained on a screen with 1/4" square openings; and for either course it shall be uniformly graded. The finer material shall consist of sand and clay or other binding material approved by the contracting officer. Should the material as received for the work fail to maintain suitable proportions of coarse and fine particles, or should the coarse particles not be uniformly graded between the maximum and minimum sizes as specified, it shall be screened or manipulated in such a manner as to furnish a material to meet the above requirements.

c. Placing. - (1) The 12-inch gravel surfacing shall be placed in two layers, a base course and a top course, each 6 inches thick after compaction. After the subgrade or foundation shall have been properly prepared and compacted and proper drainage provided, the bottom course of gravel shall be spread evenly by means of approved spreader vehicles or trucks. The material as spread shall be well-graded with no pockets of fine material or segregation of coarse and fine particles. After being spread evenly, the material shall be thoroughly compacted, by rolling with a self-propelled three-wheel roller weighing not less than ten tons, until a firm even surface is obtained. After the bottom course has been properly and satisfactorily compacted the top course shall be spread and compacted to the required thickness. If at any time the material does not contain a sufficient amount of moisture to insure proper binding of the material, water shall be added by means of a sprinkling wagon or any approved method in a sufficient amount to obtain the desired results.

(2) Rolling shall start longitudinally at the side and gradually proceed toward the center of the roadway overlapping on successive trips. During the process of rolling the material shall be dragged; the dragging and rolling shall continue until the surfacing does not creep or wave under the roller.

(3) The 6-inch gravel surfacing shall be placed in one layer 6 inches thick after compaction. Material and workmanship shall conform to that specified above for the top course of the 12-inch gravel surfacing.

d. Shoulders. - Shoulders shall be composed of gravel, practically free from loam and clay and with all stones larger than four inches removed. Before the final completion of the work the shoulders shall be reformed, trimmed, raked and rolled.

e. Measurement and payment. - The quantity to be paid for under Item 47 will be the number of cubic yards furnished and placed to the limits, lines and grades shown on the drawings or as directed by the contracting officer. The gravel will be measured in place after compacting. Payment will be made at the contract unit price for Item 41, "Gravel for Roads." The unit contract price shall include payment for all expenses incidental to furnishing, placing, rolling or otherwise compacting the gravel.

13-04. Bituminous macadam road surface (Item 48). - a. Work included. - The contractor shall furnish and place the bituminous macadam road surface shown on the drawings, in the locations shown on the drawings or otherwise designated by the contracting officer, after the gravel and riprap base shall have been placed in accordance with the drawings and the provisions of Paragraphs 8-02 and 13-02. The bituminous macadam construction is required to surface the ramps which will provide access to the top of the earth dike, including the ramp constructed by the Government hired labor forces just upstream from Connecticut Boulevard. The surface course shall be composed of broken stone and bituminous material applied by the penetration method, with a bituminous seal coat and covering of pea stone. Care shall be taken not to spatter bituminous material on surfaces adjacent to the work.

b. Materials. - The broken stone for the surface course shall consist of clean crushed rock, thoroughly screened, uniformly graded in size and quality, angular and free from rounded surfaces; and no flat, elongated or otherwise objectionable stone shall be used. All stone shall meet the following requirements:

No. 1 Stone Square openings	Per cent passing
2-1/4"	90-100
1-1/4"	0- 40
3/4"	0- 5

Pea stone Square openings	Per cent passing
1/2"	90-100
1/4"	0- 20

The bituminous material to be used in this work shall be an approved product for the purpose, either oil asphalt or refined tar. (Refer to Federal Specification R-T-121 for grades TP-1-25 or TP-2-25).

c. Placing.- (1) Shoulders shall be relined and graded before the surface course is spread, in order to hold the broken stone in place and to permit the roller to lap at least one-half the width of the rear wheel when rolling the edge of the top course. A course of No. 1 stone shall then be spread upon the prepared base course to the ordered depth and dry rolled. The rolling shall be done by a self-propelled three-wheel roller weighing not less than 10 tons. Before the No. 1 stone is spread, the pea stone shall be deposited along the shoulders in convenient piles, from which it shall be spread on the surface course as directed. No hauling will be permitted over the No. 1 stone after it has been spread.

(2) The No. 1 stone shall be spread from approved self-spreading vehicles. The course shall be spread and shaped to a true section of such depth that when the surface is finished, the depth shall be as shown on the drawings and the top surface shall be at the required grade. Rolling shall continue until the course has been satisfactorily compacted to a uniform surface. Any depressions or irregularities which may occur shall be filled with broken stone as directed, and again rolled until the surface is true and unyielding. Precautions shall be taken to prevent the depositing of dirt or other materials in the voids of the broken stone.

(3) No bituminous material shall be applied on stone which has become coated or mixed with dirt or foreign substances. No bituminous material shall be applied unless the entire depth of No. 1 stone is thoroughly dry and the air temperature is at or above 50 degrees F. After the No. 1 stone has been prepared as above, the penetration coat of bituminous material shall be applied at the rate of 2 gallons per square yard by an approved pressure distributor, at approved temperatures appropriate for the grade of bituminous material used, and distributed under approved pressures of from 40 to 60 pounds per square inch.

(4) Immediately after the penetration coat of bituminous material has been applied, a thin layer of clean, dry pea stone shall be broadcast over the treated surface in such quantity as to fill all the surface voids and just cover the treatment uniformly. The surface shall then be broomed to break up all clumps and produce a uniform covering, after which the pavement shall be rolled, in the same manner as specified for the rolling of No. 1 stone, until thoroughly compacted and bonded. Additional pea stone shall be applied as required and directed. Upon completion of the rolling the pavement shall have a smooth, even surface, free from ruts, depressions, or other irregularities.

(5) As soon as practicable after the pea stone has been rolled, the pavement shall be swept clean of any loose material and shall be treated with a seal coat of bituminous material under the same condi-

tions and in the same manner as specified for the penetration coat; except, that the rate of application shall be 3/4 gallon per square yard. Immediately after the seal coat has been applied, a thin layer of clean dry pea stone shall be broadcast over the surface in such quantity as to uniformly cover the surface with all the stone that can be made to adhere to the bituminous material, care being taken to avoid an excess. This stone shall be broomed and rolled in the manner specified above, until an unyielding, uniform and well-bonded surface is produced. Any damage to the finished surface caused by the working equipment or otherwise, shall be satisfactorily repaired.

d. Measurement and payment. - The quantity to be paid for under Item 48 will be the number of square yards of bituminous macadam surface of the required quality and thickness satisfactorily placed in the work, measured after placing. Payment will be made at the contract unit price for Item 48, "Bituminous Macadam Road Surface." The unit contract price shall include all costs of furnishing materials, equipment, tools, labor and all work incidental to satisfactory construction.

13-05. Concrete cribbing (Item 49). - a. Work included. - The contractor shall construct reinforced concrete cribbing at the landside toe of the dike as shown on the drawings. The contractor shall furnish and place rock fill inside and around the cribs as shown on the drawings.

b. Concrete crib members. - (1) The crib members shall be cast in conformity with the requirements for Class "A" concrete (see Section X). The steel reinforcement shall conform to the provisions of Paragraph 10-18. The crib members shall be free from depressions and spalls, patched or plastered surfaces or edges, or any other defects which may impair their strength or durability. Cracked or otherwise defective members will be rejected. The cribbing shall be the interlocking type requiring no metal dowels.

(2) If reinforcement details are not fully shown on the drawings, or the contractor is permitted to purchase the crib members from manufacturers, he shall submit detailed drawings and specifications for the approval of the contracting officer, and such drawings and specifications must be approved before delivery of the material is begun.

c. Construction methods. - The foundation or bed for the cribbing shall be firm and true to foundation grade and shall be approved by the contracting officer before any of the crib members are placed. Transverse concrete sill members (mud sills) shall be used to support the lower cribbing course. Crib members shall be carefully handled and erected in a manner so as to avoid any injury due to shock or impact. Any interlocking system shall be as approved by the contracting officer. Any member which becomes cracked, or otherwise injured, during hauling or erection, shall be removed from the work and replaced with satisfactory members.

d. Filling. - (1) Filling inside and around cribbing, as shown on the drawings, shall be well-graded gravel, ranging in size from pea gravel to 6-inch stone, and pervious material (see Paragraph 6-06 g), placed in a careful manner without distorting the cribbing. The gravel filling shall be constructed as a filter with the smallest sizes near the pervious material and the largest near the concrete cribbing. The pervious material required to complete the crib filling refers to pervious fill placed under Item 13 (see Paragraph 1-05, and compacted as directed by the contracting officer (see Paragraph 6-05 a).

(2) Any earth that slides in or around the crib members before the filling is placed shall be removed. Filling shall be placed in even, horizontal layers and arranged to reduce the voids to a minimum, and shall be placed as fast as the crib members are added. Any filling which may be necessary between the back of the cribbing and the face of the bank as excavated shall be made of gravel conforming to the provisions of Paragraph 7-02, and included in the payment for the concrete cribbing.

e. Measurement and payment. - (1) The quantity to be paid for under Item 49 will be the number of cubic feet in the concrete crib members placed in the completed work. Payment will be made at the unit contract price for Item 49, "Concrete Cribbing", and shall include all costs of furnishing materials, equipment and labor required to construct the concrete cribbing complete in place, except the cost of filling and any excavation required.

(2) Payment for excavation will be made under Item 4, "Common Excavation-General" (see Paragraph 4-07 d).

(3) Payment for gravel filling will be made under Item 14, "Gravel Bedding" (see Paragraph 7-02 d). Payment for pervious material will be made under Item 13 in accordance with the provisions of Paragraph 6-14.

13-06. Alterations to existing bulkhead anchors (Item 50). - a. Work included. - The contractor shall maintain throughout the construction period the existing bulkhead along the river front, at the location of the oil storage tanks as shown on the drawings. The contractor shall alter the existing bulkhead anchors or replace such anchors with new anchors, in accordance with the details shown on the drawings or as directed by the contracting officer.

b. Description. - (1) Prior to excavation for the concrete flood wall, suitable temporary anchorages shall be installed a sufficient distance, back of the lines of excavation for the contract work, on the landside of the existing concrete wall serving as the present anchorage for the bulkhead anchors. Such temporary anchorages shall be sheet-pile "dead-men" or other type approved by the contracting officer, driven to such depth and in such quantity as to afford safe temporary anchorage. Temporary anchors shall be installed from the bulkhead to the "dead-men."

(2) During the construction of the concrete flood wall the temporary anchors may be concreted into the wall at their intersections with the new construction, or if required by the contracting officer shall be suitably boxed around to allow for complete removal of the temporary anchors later.

(3) The new anchors and appurtenances required as shown on the drawings, shall be installed in conformity with the details shown on the drawings or as otherwise directed by the contracting officer. When directed by the contracting officer, the temporary anchors and anchorages shall be removed. Holes or recesses in the concrete flood wall required for the maintenance or alteration of proper anchorage for the existing bulkhead shall be repaired as directed by the contracting officer.

(4) The responsibility for the safe and adequate maintenance of the existing bulkhead during construction shall rest with the contractor. Approval by the contracting officer of the method of doing the work will not relieve the contractor of his responsibility.

c. Payment. - The contract price for Item 50 shall include payment for all materials, equipment, labor and incidentals required for the satisfactory alteration of existing bulkhead anchors, in accordance with the drawings and specifications or as directed by the contracting officer. Payment will be made at the lump sum contract price for Item 50, "Alterations to Existing Bulkhead Anchors."

13-07. Porous concrete pipe (Items 51 to 53 incl.) - a. Work included. - The contractor shall furnish and lay porous concrete pipe of the dimensions shown on the drawings, required for toe drains at the locations shown on the drawings.

b. Materials. - Pipe shall be porous concrete drain pipe, round in shape, and of the nominal inside diameters as shown on the drawings. Pipe shall have a laying length of 36 inches unless otherwise shown on the drawings, and wall thicknesses of 1-1/4 inches for the 8-inch diameter pipe, 1-3/8 inches for the 10-inch diameter pipe, and 1-1/2 inches for the 12-inch diameter pipe. Pipe shall conform to the A.S.T.M. strength specifications for drain tile and shall have a minimum permeability per 12-inch length of 2-1/2 gallons per minute per inch of pipe diameter. All pipes shall be marked with the name or trade mark of the manufacturer. Each pipe shall be carefully inspected immediately before laying and no cracked, broken or otherwise imperfect pipe shall be used, except for minor defects which in the opinion of the contracting officer do not impair the fitness of the pipe for the purpose intended.

c. Installation of pipe. - (1) Excavation. - The applicable provisions of Paragraph 9-02 b (1) shall apply.

(2) Laying pipe. - The applicable provisions of Paragraph 9-02 b (2) (a) shall apply, except for joints. Joints shall be of the interlocking or tongue-and-groove type. Where connections are made to bell-and-spigot tile pipes, the joint shall be tight and the alignment assured by a concrete ring or other means approved by the contracting officer.

(3) Backfilling. - The backfill material as shown on the drawings shall be evenly spread and compacted around and over the pipe to the limits shown on the drawings or as directed by the contracting officer (see Paragraphs 7-02 and 7-04).

d. Measurement and payment. - (1) Measurement for payment will be based on the linear feet of pipe of the respective sizes installed. Payment for pipe will be made at the contract unit prices for Items 51 to 53, respectively (see Paragraph 1-05), and shall include all costs of furnishing and installing pipe and connections, except the cost of excavation and backfilling.

(2) Payment for excavation will be made under Item 9 (see Paragraph 4-08 f). Payment for backfilling will be made under Items 14 and 16 (see Paragraphs 7-02 d and 7-04 c), as applicable to the respective backfill materials (see Paragraph 1-05).

13-08. Corrugated pipe, perforated (Items 51A to 53A, incl.). - a. Work included. - Perforated corrugated metal pipe shall be used as an alternate to porous concrete pipe (see Paragraph 13-07) if directed by the contracting officer. The contractor shall furnish and lay bituminous coated perforated corrugated metal pipe in accordance with the provisions of Paragraph 13-07 a.

b. Materials. - (1) All pipe shall be of 16-gage metal of riveted joint or locked seam type of construction, and shall meet the requirements of Federal Specification QQ-C-806, as amended March 1936, and in addition shall be completely coated inside and out with an asphalt cement, which will meet the performance requirements set forth herein. The perforations shall be 1/4 inch in diameter spaced 1-1/2 inches center to center.

(2) The asphalt cement shall be 99.5 per cent soluble in carbon bisulphide.

(3) Thickness of coating. - The entire outside of the pipe and the inside of the pipe for three-fourths of the circumference (top of pipe when installed) shall be uniformly coated to a minimum thickness of .05 inch. The thickness shall be measured on the crests of the corrugations. The interior bottom quarter of the circumference shall be 1 inch in thickness.

(4) Stability test. - The asphalt cement shall not lose its stability when subjected to the highest summer temperature,

as indicated by successfully withstanding the following test:

Parallel lines shall be drawn along the valleys of the corrugations of a representative sample of coated pipe and the specimen placed on end in a constant temperature oven, with the parallel lines in a horizontal position. The temperature of the specimen shall be maintained within 2 degrees F. of 150 degrees F. for a period of four hours. At the end of this time no part of any line shall have dropped more than one-fourth inch.

(5) Cold test. - The coating shall adhere to the metal tenaciously and shall not chip off in handling, as indicated by successfully withstanding the following test:

A steel ball 2-1/4 inches in diameter and weighing 1.67 pounds shall be dropped from a height of 7-1/2 feet through a vertical tube of 2-1/2 inch inside diameter, upon the outside crest of a coated corrugation of a full round, riveted, or locked seam section of pipe. This test shall be conducted with the specimen at a temperature of 32 degrees F. Failure of the coating on the inside of the pipe, as indicated by spalling from the metal or the formation of cracks longer than 1/2 inch from the point of impact, shall be considered sufficient cause for rejection.

(6) Imperviousness test. - The asphalt cement shall be impervious to liquids as indicated by the following test:

A 25 per cent solution of sulphuric acid, or a 25 per cent solution of sodium hydroxide, or a saturated salt solution (such as sodium chloride) shall be held in the valley of a corrugation for a period of 48 hours, during which time no loosening or separation of the bituminous material from the galvanizing shall have taken place.

(7) Erosion test. - A representative sample consisting of a two-foot length of a fully coated pipe (with ends closed by suitable bulkheads) shall be revolved end over end about its transverse axis at a speed of 3.7 revolutions per minute and in such a manner that the erosive charge shall alternately roll along the inner surface of opposite sides of the pipe (inside top and bottom, as when installed in service). At least 75 per cent of the sample shall be immersed, as it revolves, in a bath of water maintained at a temperature of 50 degrees - 55 degrees F. The top three-quarters of the pipe shall not show areas of bare metal more than two inches in length on four of the seven central corrugations after five hours of continuous testing (called a test period) and the bottom one-quarter shall not show a similar failure in nine additional periods of testing. A new corrosive charge shall be used for each period of test. The erosive charge shall be 50 pounds of grade B building brick, conforming to the requirements of the A.S.T.M. Serial Designation C62-30, broken up into pieces two to three inches in diameter, and three gallons of water.

c. Excavation. - Excavation shall be done as shown on the drawings and as provided for in Paragraph 4-08. Pipe trenches shall have a width at least 12 inches greater than the outside diameter of the pipe. The bottom of the trench throughout its length shall be carefully formed to fit the circular shape of the pipe, so that the pipe shall be firmly supported on the bottom and for at least 3 inches up each side. All rock or boulders shall be removed to a depth of 6 inches below the bottom grade of the trench and the voids backfilled with well compacted suitable material.

d. Laying pipe. - All pipe shall be placed in the trench immediately after the excavation is completed. Proper care shall be used in handling the pipe to avoid injury. The pipe shall be carefully bedded, and properly connected and jointed. The pipes shall be laid true to the lines and grades shown on the drawings or as staked in the field. The interior of the pipe shall be carefully cleaned after laying to remove dirt and other obstructions.

e. Backfilling. - Backfill material shall be evenly spread and compacted under and around the pipe. Backfill around and over the pipe shall be done in accordance with the provisions of Paragraphs 7-02 and 7-04 as shown on the drawings or directed by the contracting officer.

f. Measurement and payment. - (1) Measurement for payment will be based on the linear feet of pipe of the respective sizes installed. Payment for pipe shall include all costs of furnishing and installing the pipe except the cost of excavation and backfilling. Payment will be made at the contract unit prices for Items 51A to 53A, respectively (see Paragraph 1-05).

(2) The provisions of Paragraph 13-07 d (2) shall apply.

13-09. Cleaning up. - a. Work included. - The contractor shall remove all construction equipment and all temporary structures built or used by him, shall remove rubbish of all kinds from the site of the work, and from any grounds which he shall have occupied within the limits of the work, and shall leave the site of the work in a clean condition satisfactory to the contracting officer. All materials salvaged shall be the property of the contractor.

b. Payment. - For all work, materials and incidentals required to clean up as set forth in a above, the contractor will receive no direct payment, but payment shall be considered as having been included in the contract prices for Items 1 to 53, inclusive.

U. S. Engineer Office,
Providence, Rhode Island,
April 28, 1939.

STANDARD GOVERNMENT FORM OF BID

(Construction Contract)

(Place)_____

(Date)_____

To the District Engineer,
U. S. Engineer Office,
819 Industrial Trust Bldg.,
Providence, R. I.

In compliance with your invitation for bids dated April 28, 1939, and subject to all the conditions thereof, the undersigned

_____

a corporation organized and existing under the laws of the State of

_____

a partnership consisting of _____

_____

_____

_____

or an individual trading as _____

_____

_____

of the City of _____

hereby proposes to furnish all plant, labor, and materials, and perform all work required for the construction of Earth Dike and Concrete Flood Wall on the Connecticut River at East Hartford, Connecticut. _____

_____

_____

including all work indicated on the drawings, or required by the speci-

fications, and such incidental work as needed or ordered in writing by the contracting officer, in strict accordance with the specifications, schedules, and drawings, for the consideration of the following prices:

Item No	Designation	Unit	Quantity	Unit Price	Amount
1	Preparation of Site	acre	8.0		
2	Care and Diversion of Water and Sewage	job	--		
3	Stripping	cu.yd.	12,300		
4	Common Excavation, General	" "	13,100		
5	Impervious Borrow Excavation, Borrow Area "E"	" "	43,000		
6	Impervious Borrow Excavation, Borrow Area "C"	" "	88,000		
7	Pervious and Random Borrow Excavation (Dredging from River to Stockpile and Rehandling to Embankment)	" "	267,000		
*7A	Pervious and Random Borrow Excavation (Dredging fromRiver Direct to Embankment)	" "	170,000		
8	Common Excavation, Cut-Off Trench	" "	14,000		
9	Common Excavation, Sewer Trench	" "	4,900		
10	Removal of Masonry Structures and Foundations	job	--		
11	Steel Sheet Piling	sq.ft.	125,000		
12	Impervious Fill, Placing and Rolling	cu.yd.	116,000		
13	Pervious and Random Fill, Placing and Rolling	" "	303,000		
14	Gravel Bedding	" "	7,900		
15	Compacted Backfill	" "	3,200		
16	Semi-Compacted Backfill	" "	10,500		
				Carried Forward	$

Item No.	Designation	Unit	Quantity	Unit Price	Amount
			Brought Forward		$
17	Miscellaneous Fill	cu.yd.	4,000		
18	Dumped Rock Fill	" "	200		
19	Riprap, Hand Placed	" "	11,200		
20	Grouted Stone Gutters				
	a. 8" thick	sq.yd.	370		
	b. 12" thick	" "	650		
21	10" Corrugated Pipe	lin.ft.	24		
22	Tile Pipe, 4" V.C.	" "	20		
23	Tile Pipe, 8" V.C.	" "	95		
24	Tile Pipe, 10" V.C.	" "	30		
25	Tile Pipe, 15" V.C.	" "	905		
26	Tile Pipe, 18" V.C.	" "	984		
27	Tile Pipe, 20" V.C.	" "	412		
28	Tile Pipe, 24" V.C.	" "	412		
29	(DELETED)				
30	Cast Iron Pipe				
	a. 30"	" "	186		
	b. 36"	" "	236		
31	Reinforced Concrete Pipe				
	a. 30"	" "	612		
	b. 36"	" "	44		
32	Gate Valves				
	a. 30"	each	2		
	b. 36"	"	2		
			Carried Forward		$

Item No.	Designation	Unit	Quantity	Unit Price	Amount
			Brought Forward		$
33	Flap Valves				
	a. 30"	each	1		
	b. 36"	"	1		
34	Sluice Gates, 36"	"	2		
35	Removing Old Sewer Pipe	job	--		
36	Manholes, complete	each	10		
37	Portland Cement	bbl.	6,800		
38	Concrete in Flood Wall	cu.yd.	4,700		
39	Concrete in Miscellaneous Structures	" "	280		
40	Steel Reinforcement	lb.	436,000		
41	Miscellaneous Structural Steel	"	1,000		
42	Miscellaneous Iron and Steel	"	5,100		
43	Copper Water Stops	"	700		
44	Topsoil on Embankment	cu.yd.	11,500		
45	Sodding and Seeding	acre	12		
46	Surfacing for Top of Dike	cu.yd.	900		
47	Gravel for Roads	" "	450		
48	Bituminous Macadam Road Surface	sq.yd.	1,170		
49	Concrete Cribbing	cu.ft.	1,850		
50	Alterations to Existing Bulkhead Anchors	job	--		
51	8" Porous Concrete Pipe	lin.ft.	3,850		
52	10" Porous Concrete Pipe	" "	1,380		
53	12" Porous Concrete Pipe	" "	870		
**51A	8" Corrugated Pipe, Perforated	" "	3,850		
**52A	10" Corrugated Pipe, Perforated	" "	1,380		
			Carried Forward		$

Item No.	Designation	Unit	Quantity	Unit Price	Amount
			Brought Forward		$
**53A	12" Corrugated Pipe, Perforated	lin.ft.	870		

TOTAL BID

*Item 7A is an alternate to Item 7 for the quantity stated if the contract is written to include Item 7A. The same decrease in quantity will also apply to Item 13.

**Alternate to Items 51, 52 and 53 respectively.

Notes: (1) All amounts and total given above will be subject to verification by the Government. In case of variation between unit bid price and totals shown by bidder, the unit price will be considered to be his bid.

(2) All bids must be for the entire work and must have each blank space filled.

(3) The quantities of each item of the bid as finally ascertained at the close of the contract, and the unit prices of the various items stated by the bidder in the accepted bid, will determine the total payments to accrue under the contract. The unit price bid for each item must allow for all collateral or indirect costs connected with it.

(4) The total bid shall be based on the lesser price in the case of alternate bids (Items 7, 51, 52 and 53), and on the applicable figure for Item 13.

PLANT TO BE USED ON THE WORK

(See Invitation for Bids and Paragraph 1-09 of the specifications)

Note:-- Use separate line for each major item.

No.	Name	Kind	Capacity	Age and Condition

Material Handling Equipment

Dredging and Pumping Equipment

Earth Embankment Equipment - Rolled Fill
(Excavation and Transportation)

(Spreading and Rolling)

Rock Fill and Riprap Equipment

Excavating Equipment

Concreting Equipment

Miscellaneous Equipment

EXPERIENCE. - (See Invitation for Bids)

Occupation	No. Expected to be Employed	Number of Months Employed
Laborer		
Teamster		
Watchman		
Fireman		
Foreman		
Carpenter's Helper		
Powderman's Helper		
Air Compressor Operator		
Crusher Operator		
Grader Operator		
Jackhammer Operator		
Pump Operator		
Tractor Operator		
Truck Operator		
Blacksmith		
Blaster or Powderman		
Carpenter		
Electrician		
Derrick Operator		
Hoist Operator		
Power Shovel Operator		
Roller Operator		

It is hereby warranted that in the event award is made to the undersigned there will be used in the performance of the work covered by the contract only such unmanufactured articles, materials and supplies as have been mined or produced in the United States and only such manufactured articles, materials, and supplies as have been manufactured in the United States all from articles, materials, or supplies mined, produced or manufactured, as the case may be, in the United States, except as noted below or otherwise indicated in this bid or authorized in the specifications.

The undersigned agrees, upon receipt of written notice of the acceptance of this bid within 60 days after the date of opening of the bids, to execute the standard form of Government contract, in accordance with the bid as accepted, and to give the required performance and payment bonds, with good ans fufficient surety or sureties, for the faithful performance of the contract, and for the protection of all persons supplying labor and materials in the prosecution of the work, within 10 days after the prescribed forms are presented for signature.

Performance will begin within 10 calendar days after the date of receipt of notice to proceed and will be completed within 400 calendar days after date of receipt of said notice to proceed.

_____
(Bidder)

_____
(Address)

By _____
(Name) (Title)

NOTE: - Read Standard Government Instructions to Bidders before preparing this bid.